

STATE OF NEW YORK



FOREST, FISH

AND



1902

1903

EIGHTH & NINTH REPORTS



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nd Game

On

of the

State of New York

Eighth and Ninth Reports

of the

Forest, Fish and Game

Commission

of the

State of New York



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Preface



THE preparation of the Annual Report of the Commission, in this enlarged or supplementary form, requires so much time and care that its publication has been delayed beyond the date which appears on the title page. It has been the custom of the Commission to issue its Annual Report promptly in January of each year as required by law, but in pamphlet form, containing the usual financial statement and a brief record of the more important work accomplished, together with such suggestions or recommendations for further legislation as seemed advisable. This pamphlet was followed in time by the larger, supplementary volume, bound in cloth, containing additional articles and illustrations of a character pertinent to the various lines of work and interests included within the scope

and province of the Commission. The department official to whom is entrusted the work of collecting and editing the material for this larger volume, together with the selection of the illustrations, is unable to devote any time to the work except such spare intervals as may occur while attending to his regular duties, after which the State printer must have the time necessary for the production of a book of this character and the artistic colored illustrations that accompany the text. For these reasons the publication of the large illustrated quartos containing the final or supplementary reports have been delayed so much that it has become necessary to include the Eighth and Ninth Reports of the Forest, Fish and Game Commission in one volume, as presented here. Hereafter, if the Legislature decides that the publication of these amplified, illustrated reports shall be continued, the volume should be issued biennially and include two years in one binding.

The action of the Legislature in authorizing the publication of these volumes is amply justified by the high esteem with which they are regarded by the people, and the urgent, widespread demand for extra editions. Requests for copies, in great number, are received from people outside the State and from libraries in Europe. The Imperial Library of Japan has sought earnestly to secure a full set of these books, and far-off Australia has been more than once represented in the applications received from scientific men engaged in the study of fish culture, the problems of forest preservation and of water storage, and the work of game protection.

The contributed articles on forests, fish and game are written by men who are acknowledged authorities on the subjects treated by them, and these pages, together with the beautiful colored illustrations, have an educational value that cannot be computed in dollars and cents.

For the articles courteously written expressly for this volume the Commission desires to make suitable acknowledgment to Mr. Madison Grant, Secretary of the New York Zoological Society; Dr. F. E. L. Beal, of the United States Biological Survey, Washington, D. C.; Hon. A. J. Northrup, of Syracuse N. Y.; Dr. Frederick C. Paulmier, Zoologist in the Division of Science, New York State Museum, and Major J. H. Durham, U. S. A., Cape Vincent, N. Y. These papers, together with those furnished by officials of the Commission, contain valuable information as to forestry, tree planting, birds, wild fowl, fish, game, and the culture of shellfish, which the people of our State cannot find elsewhere conveniently. Furthermore, these articles will be read with deep interest by scientific and professional men, although they may be already familiar with the subjects treated.

Particular attention is called to the valuable report on forest conditions existing on Townships 5, 6, and 41, in Hamilton County, N. Y., as this great tract of 75,000 acres, covered with a virgin forest, belongs to the State and forms a part of the Adirondack Park. The field work, which forms the basis of this special report, was done in cooperation with the United States Forest Service, Washington, D. C., through an arrangement made by the Commission with Mr. Gifford Pinchot, Forester, the head of the Government forestry bureau. Under this arrangement the General Government furnished, free of expense, the services of an expert corps of foresters, while the State of New York defrayed the cost of camp maintenance, guides, helpers, and other expenses. Although this report, as made by the United States official in charge of the work, is designated a "Working Plan," it was distinctly understood by both parties that,

owing to the restrictions in the forestry clause of our State Constitution, no timber cutting could be done, and that in this respect the plan was necessarily inoperative. But after a long and thorough examination of this large tract with reference to its conditions, the forester in making his report deemed it a proper opportunity to indicate the large revenues that could be obtained annually from this forest under an intelligent, conservative management in case the State Constitution were amended at some future time so as to permit the adoption of such a plan.

The Commission on its part improved the opportunity to obtain for its information and guidance the valuable data giving in detail the amount of standing timber, the different species, the rate of growth, the topographical features of the tract, and other valuable items showing the condition and value of the property.

In view of the general opposition to any amendment of the forestry clause in the State Constitution the Commission disclaims any responsibility for the suggestions contained in the article referred to, although the plan is necessarily only a tentative one.

THE COMMISSION.



Eighth Report
of the
Forest, Fish and Game Commission

Albany, N. Y., January 30, 1903.

Hon. S. Frederick Nixon,

Speaker of the Assembly:

Sir.—We have the honor to submit herewith, as required by law, the official report of this Commission for the year ending September 30, 1902.

Very truly yours,

Timothy L. Woodruff,

President,

Dewitt C. Middleton,

Charles H. Babcock,

Commissioners of Forest, Fish and Game.

State of New York

Forest, Fish and Game Commission.

Timothy L. Woodruff, President,	-	-	-	-	-	-	Brooklyn, N. Y.
Dewitt C. Middleton,	-	-	-	-	-	-	Watertown, N. Y.
Charles H. Babcock,	-	-	-	-	-	-	Rochester, N. Y.

Standing Committees.

Forestry,	-	-	-	-	-	-	Commissioner Middleton.
Fishculture and Hatcheries,	-	-	-	-	-	-	Commissioner Babcock.
Shellfisheries,	-	-	-	-	-	-	Commissioner Woodruff.

Assistant Secretary,	-	-	-	-	-	John D. Whish, Albany, N. Y.
Superintendent of Forests,	-	-	-	-	-	William F. Fox, Albany, N. Y.
Chief Game Protector,	-	-	-	-	-	J. Warren Pond, Albany, N. Y.
Superintendent of Shellfisheries,	-	-	-	-	-	B. Frank Wood, Jamaica, N. Y.

Report

of the

Forest, Fish and Game Commission

1902

To the Honorable the Legislature:

THE Commission, in presenting its final report as at present constituted, has the pleasant satisfaction of knowing that its work has had the commendation of the public, and that the value of what has been done for the protection of fish and game and the reforestation of denuded woodlands in the Adirondack and Catskill regions has been recognized both at home and abroad.

Standards of comparison for such matters are not as well established as yet in our own country as they are in other parts of the civilized world, and an occasional criticism is consequently to be expected either from the uninformed or the unthinking. But it is certain that, dollar for dollar, the State of New York is getting more for its expenditure for the business which the Commission has had in charge than any other locality at present known. The work of the Forestry Department has developed in value to the extent that its success is frequently commended, and its documents are considered very desirable for public distribution. Advice on important questions is sought by the experts of other countries from our Department of Fisheries, and the game laws of this State are frequently used as models by other lawmakers.

The sagacious editor of the London *Spectator*, in reviewing a recent report of this Commission, after paying a high tribute to the wisdom shown by the State of New York in providing adequately for the preservation of its forests and the increase of its fish and game supply, says:

Omitting moneys spent on purchasing land and maintaining forests the total cost of fish propagation, fish and game protection, the Shellfish Department and taking deer to the forests, with some items for printing, was about £30,000. The fish cost

a little over £11,000, the gamekeeping generally £10,000, and the shellfish (a remunerative item) £2,000. In return for this the public had free fishing of every kind over a vast territory, and killed deer to an amount which, at the ordinary rate reckoned per stag in Scotland (£40), would represent a sporting rental in this country of £169,000!

In the same line of testimony is the following quotation from a scientific monograph produced in our own State by an expert of well-established reputation. In a recent bulletin on "The Clam and Scallop Industries," issued by the State Museum, Dr. J. L. Kellogg says:

Every one is familiar with the extensive and remarkably successful work of the United States and the various State Fish Commissions in the propagation of marine and fresh water market fish. In many cases the continued supply is probably directly and entirely due to the artificial hatching and judicious distribution of the young fish. These institutions have made it very clear that public moneys could not be better expended for the benefit of all classes of people than in their support. * * * If the fact were only recognized that this extinction of forms really is occurring, these Commissions and similar institutions would receive much greater support in the form of legislative appropriations. * * * It is money most profitably invested for rich and poor alike.

Such testimony and approval of the work that is being done could be continued at length, but the facts are, for the most part, known to your honorable body and to the well-informed taxpayers of the State at large. The value of the Adirondacks as a wealth-producing element in the State is properly shown in one of the appended reports, and the figures given indicate that millions of dollars are annually spent because of the attractions of the woods and waters for health and pleasure seekers and sportsmen. To preserve and build up the forests has been the constant care of the Commission, and many members of the Legislature can testify from actual knowledge as to what has been done toward providing trees to fill out the denuded places. The nurseries for producing the young trees are well established, and will increase steadily in value as the work advances. In time the State will be able to provide from them not only all the trees necessary for use in the forests but also for beautifying roadsides and the streets of our cities, as well as for renewing the old and neglected woodlots of our farms.

Attention is also called with pride to the work done in protecting the forests from fire. The State now has a most excellent organization for this purpose, and the result is readily seen from the fact that our forests have practically escaped damage from this source. Reports from other States do not show such immunity. The statements in detail in the reports of the Superintendent of Forests, the

Chief Protector and the Superintendent of Shellfisheries, which follow, are well worth the attention of every sportsman and every taxpayer as well. Therein will be found ample evidence that the money appropriated for the propagation of fish and the protection of game has been well expended, and that the result secured has merited the favorable comment already quoted. Communications received from time to time bear witness to the fact that line fishing in the waters of the State was never better, while the returns from the net fishermen prove that a far greater variety of cheap food-fish of the best quality is easily procurable on account of the constant care exercised by the State in stocking its waters. The increase in the number of deer taken is also worth noting, as an evidence of the wisdom of existing laws. So also is the suggestion which experience has shown to be necessary for the preservation of certain fisheries by stopping fishing through the ice. Protective action would also seem to be necessary to keep the Black Bear from extermination.

The Commission, in conclusion, takes pleasure in calling attention to the success which has thus far attended the work of restoring Moose to the Adirondacks, and to the valuable additions made to the herds of Elk during the past year.

The following recommendations are presented for your consideration:

That the number of expert foresters be increased to four, and their compensation be made such as to retain them in the service of the State.

That the John Brown house be repaired so as to preserve this historic structure.

That spring shooting of wild fowl and birds of all kinds be prohibited.

That the shooting of Black Bear in the Adirondack region be prohibited for a period of five years.

That a license fee of fifty dollars be imposed on non-resident hunters, excepting members of organized clubs in the Adirondacks, who shall present certificates of membership, and Adirondack landowners.

That provision be made for the licensing of guides.

BY THE COMMISSION.

JOHN D. WHISH,

Assistant Secretary.

Report of Superintendent of Forests

1902

To the Forest, Fish and Game Commission:

GENTLEMEN.—In carrying on the forestry work of the Commission during the past year special attention has been given, as usual, to the protection from fire of the forests in the Adirondack and Catskill towns, both public and private. The results are satisfactory and encouraging.* While many other States, especially those of the Northwest and Pacific slope, have suffered severe losses from forest fires, the wooded areas of New York have been comparatively free from any serious or extensive damage from this source, the fires in this State having occurred, for the greater part, on waste lands or tracts that had been burned over previously, some of them repeatedly.

The total area thus injured in 1902, as shown by the reports of the town firewardens, embraced 21,356 acres, three fourths of which, or thereabouts, consisted of waste land, on which there was no standing timber of merchantable value. The actual area of forest land overrun by fire amounted to only 4,345 acres, of which 458 acres belonged to the Forest Preserve.

The total loss on this standing timber, as taken from the estimates in the firewardens' reports, amounted in the aggregate to \$9,150. The total number of days worked by the men ordered out to fight fire was 2,405. As the State refunds to the towns half of the expense incurred in such work, the amount due from the Commission in settlement of these claims is estimated at \$2,700. The exact sum cannot be stated now, as a few of the firewardens' accounts have not yet been adjusted by their respective towns, the auditors having taken exception to some of the items, or having refused to pay the bill entirely. There will be no rebate to towns which are still in debt to the State for money advanced to hire men during the fires of 1899.

As usual the causes of these fires were various, the principal ones being in

*The great fires of 1903 had not occurred at this time. For a full account of this disaster see Annual Report of the Superintendent of Forests for 1903, page 101.

their order as follows: The carelessness of farmers in burning brush for agricultural purposes; sparks from railroad locomotives, and the camp (or coffee) fires left by fishermen and hunters. Berry-pickers, tramps, picnic parties, summer boarders and boys at play were each responsible for one or two cases. One fire was started by an insane man, and one caught from a charcoal-burner's pit. The returns include also, as in previous years, a large number of reports with the statement, "Cause unknown."

The figures for the forest area burned (4,345 acres) and the total damage (\$9,150) show a gratifying decrease when compared with the great losses from this source which occurred almost annually in New York before the establishment of its Forestry Department. Perhaps their significance will be better understood if considered in connection with the statistics showing the total burned area and loss from forest fires throughout the United States, in which, according to the estimates of the United States Bureau of Forestry, there occur annually forest fires that on an average burn over an area of 10,274,089 acres, destroying at least \$25,000,000 worth of real property, and in which, on an average, sixty human lives are lost yearly. A special agent of the Government Bureau, after a careful examination of the territory, reports that the forest fires this last fall in the States of Oregon and Washington destroyed standing timber and other property to the value of \$12,767,100. He might have added that these fires were accompanied by the usual loss of life. Thirty-eight dead bodies were found in one place—in the Lewis River Valley, Washington. In our neighboring State of New Jersey forest fires last year covered 98,850 acres, and inflicted damages to the amount of \$168,333 as officially reported.

These statistics need not excite surprise if one recalls the terrible loss of life and widespread destruction of timber from forest fires that have occurred repeatedly in the Northwestern States. In the great fires that swept over parts of Northern Michigan, Wisconsin and Minnesota in October, 1871, over 1,000 persons lost their lives and 15,000 were made homeless. The value of the standing timber destroyed was never estimated closely, but it amounted to several million dollars. In the fires of 1881, 1894 and 1896 hundreds of people were burned to death and wide areas of valuable timber destroyed in that same region.

And yet these fires started from some little blaze that, as was the case with the Hinckley disaster in 1894, had smoldered for days before it attained headway,* and which could have been prevented had there been an efficient organization for extinguishing them while in an incipient stage.

* A detailed and interesting account of the great fires of 1894 may be found in the Annual Report of the New York State Forest Commission for that year.

In the returns made by the firewardens of the State of New York for the year 1902 much of the burned territory included in their reports consisted of open country on which there were no trees, the land being covered with brier patches or shrubs of small growth. There were large areas also, covered with huckleberry bushes, that were set on fire and burned over by the natives to increase the crop of fruit gathered annually from these places. This was especially the case in some of the Catskill towns, where the picking of berries on wild land furnishes employment each season for a large number of people—men, women and children. These areas, if not burned over, would in time be covered with a growth of trees that would be valuable for the protective functions exercised, even if the species did not furnish marketable timber. These trees would be available also for fuel; and the saplings, when properly thinned by foresters, would supply, to a large extent, the market for hoop-poles. The wardens have made special efforts to prevent fires of this class, with the result that the burned areas from this cause have been materially reduced. Still, as there is great difficulty in detecting offenders of this kind, the recurrence of the evil to some extent may be expected each season. It is doubtful if the time will ever come, however vigilant and watchful our firewardens may be, when forest fires will entirely cease. If all our citizens were intelligent, careful and honest there would be no fires. But this millennial condition has not arrived, and we cannot expect entire exemption for our forests any more than for our cities and villages, which for many years to come will find it necessary to maintain their fire departments.

In some of the Catskill towns there has been a disposition on the part of the auditing boards to throw out the bills of the firewardens entirely, the supervisors claiming that as there is little or no State land in the town the Forest Commission had no right to appoint a firewarden, and that the town can take care of its own affairs in this respect without any intervention by the State authorities. But the Forest Law provides that: "The Commission shall from time to time in every town having lands which are part of the Forest Preserve, *and may in every town having lands which would become part of the Forest Preserve if acquired by the State*, appoint a firewarden who shall act during the pleasure of the Commission."

The clause italicized here became necessary because of the negligence shown by the authorities of certain forest towns in protecting their woodlands from fire. It is conceded that the State holdings in these towns are small, and that in a few instances there are none. But these towns contain large wooded areas, a great portion of which are owned by non-residents. The public interests demand that these forests should be protected and preserved, no matter who owns them. True, a private owner can cut his timber if he wants to, but the people at large



C. R. PETTIS, PHOTO.

ATTACKING A FIRE IN TIME.



A. B. STROUGH, PHOTO.

AN ADIRONDACK "FIRE-TRAP."

will naturally protest against its unnecessary destruction by fire. The observation of the Department has been that in the towns where there are no firewardens belonging to the organized force the forests are destroyed to an alarming extent. In such towns the supervisor is firewarden *ex officio*, being invested with all the powers and duties pertaining to that office elsewhere. But the supervisor too often is unaware that he must act as firewarden; he is not in touch with the Chief Firewarden of the State; he lacks the interest and efficiency displayed by the firewardens in the organized force, and, as he holds an elective office, he must give way in time to his successor instead of holding the position permanently like the firewardens appointed by the Commission.

It has been suggested that when a recalcitrant town board refuses to recognize the firewarden appointed by the Commission, merely because the State owns little or no land in the town, the Commission might in retaliation make no appointment of a firewarden and thus deprive the town of the rebate of one half the expenses incurred in fighting its forest fires. But this would not remedy the real evil—the undue destruction of woodlands in that locality.

As an instance of the lack of attention given to forest fires in towns outside the counties containing the Forest Preserve, and in which there is no organized force under the control of the Chief Firewarden, let me cite a representative case: In 1899, in the town of Adams, Jefferson County, a forest fire was raging, whereupon the residents in its vicinity notified the supervisor that he ought to give it necessary attention. He neglected to do so, paying no heed to the danger aside from asking some one to look after the fire and extinguish it. Ineffectual attempts were made by a few of the people to check its progress, and from Tuesday to Friday of the same week the supervisor was appealed to by interested parties to protect their property. These people informed him that the men he had asked to go to the fire were not accomplishing anything, and that the neighbors would not turn out to fight the fire under the orders or direction of the men he had engaged to attend to it.

On Friday, after much had been said about his neglect of duty, he went to the fire, ordered out a posse of citizens, assumed charge of the work and extinguished the flames; but not until the woodlands of several people had been destroyed or seriously damaged. One of the parties whose woods had been injured, Mrs. Lois L. Garnett, sued the supervisor for neglect of duty. The case was finally disposed of in the Supreme Court at Watertown, N. Y., in May, 1902, the plaintiff obtaining a verdict for damages in the sum of \$252. As others were ready to commence similar actions as soon as the case was decided, an appeal was taken for the purpose of effecting a settlement with the various claimants in order to save the supervisor

from the expense of further litigation, after which he made a satisfactory arrangement with each of the aggrieved parties. The negligence of the supervisor in this instance cost him \$1,659.79 to settle the various claims, not including the additional expense of litigation, all of which he must lose unless the taxpayers of the town vote to reimburse him.

It has also happened that in the prosecution of persons for violation of the Fire Law satisfactory results were not always obtained, owing to the reluctance of the jury to find a verdict in favor of the State as against a neighbor. In each case the attorney for the defendant appealed to the sympathy of the jury in favor of his poverty-stricken client, so described, and at the same time derided and denounced the State officials, who were represented as persecuting the poor farmer and seeking to prevent him from planting a few potatoes on his own land, or burning a fallow preparatory to the same.

Last spring the Chief Firewarden arrested two men in Lewis County for burning brush and logs during a period prohibited by law, and for allowing the fire to escape to adjoining forests, where it caused a serious destruction of timber. It was a second offense, the defendants having been convicted of the same violation of law in the previous year. The case was tried at Lowville before a justice of the peace and a jury summoned especially for this action. The evidence was more than sufficient to prove the guilt of the prisoners. Reputable citizens testified that they were on the ground and saw the parties heaping up the brush and logs on burning piles. The local firewarden swore that he remonstrated with them for starting a brush fire at that time in violation of the statute, and further testified that the forest fire which ensued was directly traceable to the burning brush heaps. But the jury rendered a verdict of not guilty. The evidence against the defendants, however, was so ample and convincing that the Chief Firewarden appealed the case to the Supreme Court, where the action is now pending.

Some of the farmers living in the forest towns complain that the close season on fallow fires interferes with their agricultural work. The State Forestry Law provides that in certain specified towns fallows shall not be burned between April 1st and June 10th, or from September 1st to November 10th. This provision became necessary owing to the large number of woodland fires that caught from burning fallows each year during these periods, and which could not well occur if the trees were in full leaf. It is admitted that the law is a hardship to some extent, but the carelessness of petty farmers in the use of fire for clearing wild land became so widespread and unrestrainable that no other remedy was available.

During the past season the Chief Firewarden has prosecuted successfully thirteen actions against parties who burned their fallows out of season, the fines thus

collected ranging from fifteen to twenty-five dollars in each case—in most of the instances the latter amount. Some of the parties thus arraigned protested strenuously, urging in extenuation of their offense that the fire was wholly on their own land; that it had not escaped therefrom into any woods or on to the property of any other person, and furthermore, that they had gone to an extra expense to prevent any such occurrence. In reply it was pointed out to them that, while this was readily conceded, there were many others who were not so careful in managing their fires, and that, in prosecuting the latter, no opportunity should be given them to charge that any distinction or alleged favoritism had been made in proceeding against all persons who set fire to their fallows during the close season established by law.

In connection with this subject ample acknowledgment is due Mr. L. S. Emmons, the Chief Firewarden, for the energetic, fearless work performed by him in prosecuting violations of the law, and for the efficient service rendered in discharge of all the various duties pertaining to his office.

Reforestation.

At the risk of what may seem a useless repetition of former reports, I again call attention to the fact that, owing to the restrictions in the forestry clause of the State Constitution, this Department cannot undertake any scientific work in the line of forest improvement that necessitates the cutting of timber. The woodlands placed under the care and management of the Commission must remain as they are—untouched and unimproved. Our foresters are debarred from doing any work that would increase the productivity of these forests by the cutting of diseased or decaying trees, or by the substitution of merchantable species for worthless ones. Matured trees must be left to fall and become breeding places for destructive insects, while under the clearly expressed mandate of the law no timber can be removed and converted into money, even when it is killed by fire, or where, still green and uninjured, it covers the ground for a thousand acres or more in some windfall. This is not said in any spirit of complaint, or in advocacy of any change in the law; but rather to account for the absence of any scientific forestry work in the management of the woodlands belonging to the State. Some such explanation seems necessary in view of the thoughtless criticisms that have been made by persons who were evidently unaware that the improved methods of forest treatment suggested by them could not be undertaken lawfully by the Commission.

Fortunately, the Constitutional restrictions do not interfere with silvicultural operations incidental to the reforesting of denuded lands, and so the Commission

has undertaken the work of planting the burned and waste areas of the Preserve with seedling trees of merchantable species. That there is a wide field for operations of this kind is evident, in view of the fact that within the Adirondack Park there are 50,592 acres classified as waste, burned or denuded, to say nothing of a similar class of lands in the Forest Preserve which is situated outside the park boundary, or so-called "Blue Line."

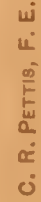
Small plantations had already been made by our foresters on State lands in the Catskills in 1900 and 1901, the comparatively slight expense of which encouraged the Commission to undertake, last spring, the reforestation of a large tract in the Adirondacks. In Franklin County, near Lake Clear Junction, there is a large area of State land that had been closely lumbered, after which it became denuded by repeated fires. The ground, which originally sustained a growth of large White Pine, was covered with ferns and huckleberry bushes, with here and there small areas of swampy land or thickets of young evergreens and poplars. It was mostly an open plain, extending several miles in either direction, its level expanse being broken in places by low hills or long, rolling ridges. The soil is sandy, covered with a thin deposit of ashes left from forest fires. The latter conditions, however, were not unfavorable; for a sandy soil forms the natural habitat of the White Pine, and the small admixture of ashes has some value as a fertilizer.

The highway from Saranac Inn to Harrietstown skirts the northern boundary of the tract, while a branch of the New York Central Railroad, running from Lake Clear Junction to the village of Saranac Lake, passes through its central portion. The land includes all, or parts, of Lots 105, 106, 93, 63, 62 and 64 of Township 21, Macomb's Purchase, Franklin County, as shown on the large Adirondack map published by the Commission.

Early last spring, as soon as the ground was free from snow, a careful examination of this territory was made by Commissioner Middleton and the Superintendent of Forests with reference to the feasibility of undertaking reforestation operations there. The only objection noted at the time was the proximity of the railroad, which would form a constant source of danger from fire. This difficulty was offset to a considerable extent by the fact that a district firewarden resided close by, and that a number of people living in the immediate vicinity were always available as a force for fighting fire.

Having decided to undertake the planting of about 700 acres of this tract the question naturally arose as to the species which should be used. The White Pine is the most available of our forest trees, and, as it had originally covered this ground with a natural growth, preference was given to this species. The selection was further indicated by the sandy soil which elsewhere throughout the Adiron-

1902.





TOWNSHIP 21,
FRANKLIN CO., N.Y.
PLANTATION ON STATE LANDS
MADE BY
FOREST, FISH AND GAME COMMISSION.
1902.

dacks is generally found in connection with this famous tree. But, as white pine seedlings sufficient to cover the entire area could not be obtained at a satisfactory price, other species would have to be used. Preference was accordingly given to spruce as the next best; and, as none of the nurseries in this country or abroad had done anything in the way of propagating our native spruce, recourse was had to the Norway Spruce, a species which has been grown successfully in European forests as a timber tree, and has also been raised extensively in American nurseries for park or lawn purposes.

The Axton nurseries, operated by the State College of Forestry, having offered a stock of seedlings at a low price, an order was given at the following rates:

50,000 White Pine transplants, 4 years old, at \$6.25 . . .	\$312 50
10,000 White Pine seedlings, 2 years old, at \$5 . . .	50 00
40,000 Scotch Pine transplants, 3 years old, at \$4 . . .	160 00
10,000 Scotch Pine seedlings, 2 years old, at \$3 . . .	30 00
50,000 Norway Spruce transplants, 3 years old, at \$4 . . .	200 00
200,000 Norway Spruce seedlings, 2 years old, at \$1.50 . . .	300 00
25,000 Douglas Fir seedlings, 2 years old, at \$5 . . .	125 00
30,000 European Larch seedlings, 2 years old, at \$2 . . .	60 00
5,000 Black Locust seedlings, 2 years old, at \$1 . . .	5 00
	<hr/>
	\$1,242 50
	<hr/>

The White Pine transplants, four years old, were from ten to twelve inches in height; the seedlings, two years old, ranged from four to six inches. The small quantity of Larch, or Tamarack, as it is called in this country, was ordered for experimental purposes, these plants being used principally where the ground was low and wet; for this species finds its habitat, as a general rule, in swampy land, although at some places in the Adirondacks it has attained a thrifty growth on a high, dry situation. The Locust was also ordered for experimental work. The plants were hauled in wagons from Axton to the planting ground, a distance of seventeen miles, at a cost of \$106.50, not including the board of the men and teams employed on this part of the job.

The work of setting out the little trees, together with the general management, was entrusted to Abraham Knechtel, F. E., assisted by Mr. Clifford R. Pettis, F. E., who attended to the alignment of the rows, acted as timekeeper, and who has had charge of the plantation since. Mr. Ernest A. Sterling, F. E., also on the staff of the State Forestry Department at that time, remained at Axton, where he prepared the plants for shipment and verified the count. The planting was

commenced on April twenty-second and was completed May thirteenth, during which period over half a million of young trees were set out. From forty to sixty-two men were employed daily on the work. The weather was cool and cloudy with an occasional flurry of snow, conditions that, on the whole, were deemed favorable. The plants were placed in rows, at spaces six feet apart each way, a somewhat crowded condition being sought in order to facilitate the proper shedding of the lower limbs in time, and to promote the necessary growth in height. This spacing was adopted with reference to a thinning fifteen to eighteen years hence, at which time the trees should be from sixteen to twenty feet high. The thinnings can then be sold for pulp-wood or fuel; and it is expected that the revenue from this source will offset the expense of the plantation up to that time.

The advantages of a plantation composed of mixed species as compared with one containing a pure stand were fully discussed, preference being given to the former, more especially for White Pine and Larch, which, on account of their habit of open growth, expose the soil to the drying influences of sun and wind, and which, when grown in pure stand, do not readily shed their lower branches. These were mixed with Norway Spruce, only a small area of each being planted unmixed for comparison.

In setting out the plants the men were divided into two gangs, one of which was provided with mattocks for digging the holes, while the other carried pails filled with the seedlings, the roots of which were immersed in thick, muddy water. The men were formed in two parallel lines, the mattock men in the front line six feet apart, closely followed by the second line, which was composed of the planters with their pails of seedlings.

Three or four strokes of a mattock* were enough to make a shallow hole in the sandy soil of sufficient depth for a seedling tree. The planter, who in each case followed a mattock man, dropped on his knees at each hole, and taking a plant from his pail placed it quickly in the ground, packing the loose earth closely around the roots with his hands, after which he packed it still more firmly with his foot before going to the next place. With the work thus systematically arranged, the two lines of men moved across the fields at an even pace, covering the ground at a rate that was extremely satisfactory. As the planters, in order to keep up with the mattock men, had the hardest task, the gangs changed off in their work after each crossing of a field, the planters then digging the holes and the mattock men carrying the pails.

*The Commission imported a supply of Würtemberg planting irons from Germany for use on this plantation, but for general work a mattock or grub hoe (single blade) proved more satisfactory than the heavier German implement.

As this was State work the men labored only eight hours a day in accordance with the provision of the Labor Law regulating the hours on public works. The laborers received a dollar and fifty cents per day, while the foremen, of whom there were three, were paid two dollars per day. Ordinarily men cannot be obtained in the Adirondacks at these wages, but the work was done at a season of the year when there is little doing in the lumber regions or on the farms, a fact which should be remembered when discussing the relative advantages of spring and fall planting.

On favorable ground, when free from interruption by bad weather or other causes, two men (a mattock man and his planter) set out about 1,600 plants in eight hours, or one day's work. But this average was not sustained during the entire course of the planting. It required 747 days' labor—including foremen, laborers and water boys—to set out the 500,000 seedlings provided, or 669 plants per day for each man and boy on the job. The total expense of the plantation, including purchase price of seedlings, cartage on same and labor, amounted to \$2,496.22, or less than half a cent per plant.

The large gang of laborers employed obtained board and lodging at houses in the immediate vicinity of Lake Clear Junction, or near Lots 105 and 106, the first ones planted. But when the work extended to the lots farther south it was found that too much time was consumed in walking to the ground each morning and in returning at night. Forester Knechtel then made a written application to Mr. F. A. Harrington, Division Superintendent of the New York Central Railroad, asking for transportation for the men to and from their work, whereupon Mr. Harrington kindly ordered that free transportation be furnished on the railroad, and that the passenger trains on the Saranac Lake Branch should stop morning and evening to let off or take on the planting gang at whatever points on the line might be most convenient for the work.

The seedlings having been set out at intervals of six feet, there were 1,210 plants per acre, and hence the ground actually occupied by the half million seedlings includes only 414 acres. But owing to frequent obstructions, swampy places and thickets of sapling trees, the boundaries of the territory planted embrace nearly 700 acres.

The thick growth of ferns, which covered the ground and could not be removed except at too great an expense, caused some apprehension through fear that it might choke the young plants or seriously retard their growth. But nothing of the kind occurred, and the little trees grew thriftily among the overshadowing brakes, which, in fact, proved valuable as a protection against the heat of the sun in July and August.

Mixed with the ferns was an abundant growth of huckleberries that furnished another cause for anxiety when the picking time came lest the young trees, hidden from view by the ferns and bushes, might be trampled and killed by the people who thronged the adjoining plains while gathering the fruit. As the plantation was on public land, unfenced, some plan had to be devised for keeping the berry-pickers off the ground. To this end Forester Pettis, with two laborers, using short scythes or bush-hooks, went over the planted territory and cut off the tops of the huckleberry bushes before the fruit was ripe. As a result of this simple expedient the berry-pickers went elsewhere, and the plantation was not injured by them.

So far as can be observed the condition of the plantation at the present time is very encouraging. Of the half million plants set out the percentage of loss was astonishingly small—far below the number expected as based on the usual percentage of failures given in tables published by various authorities. It was only after a long and careful search that a dead plant could be found. Most of the seedlings showed a rapid growth also, the leaders on the White Pine attaining a length of from four to ten inches during the summer following the planting. The Forestry Committee of the State Legislature, Hon. Thomas M. Costello, Chairman, while on its annual tour of inspection in the Adirondack Preserve, visited the plantation last August in company with Commissioner Babcock, and each member of the Committee expressed himself as highly pleased and satisfied with the appearance of the work.

For several years to come, in early spring or late fall, there will be some danger from locomotive sparks, which may start fires in the dead leaves on the ground and spread into the plantation. But this evil can be minimized greatly by employing one or two patrols during the few months in which there is a liability to loss from this source. Last spring a fire, caused by a locomotive, started in the immediate vicinity of a planted area while the men were at work there. Driven by a high wind, it quickly assumed a threatening aspect; but the forester in charge of the planting immediately detailed a gang of men to fight it, and it was extinguished before any damage was done.

The planting having been completed, Forester Pettis was directed to make a topographical survey of the lots included in the work, using contours of ten feet. I submit herewith the map made by him in connection with this survey, on which the area occupied by each species is indicated by the special color designated in the legend.

Forest Nurseries.

If the Commission is to continue its work of reforesting the denuded lands of the State Preserve, there will be some difficulty in obtaining a sufficient quantity of seedlings for the annual plantings. It is doubtful whether the desired species can be procured in sufficient quantities. Assuming that the plants are obtainable, the current rates quoted in the price lists of the nurserymen indicate that the expense would make reforesting operations too costly or unprofitable. This difficulty may be successfully obviated by establishing State nurseries in which our foresters can propagate seedlings to furnish annually the necessary supply. Availing itself of its ownership of the land and the expert services of its foresters the Commission can provide a stock of seedlings at a comparatively small expense.

To this end a nursery has been established in the Catskills, at a location in Ulster County about one mile south of Brown's Station, on the Ulster and Delaware Railroad. After a careful examination of various pieces of land suitable for nursery purposes in that vicinity a selection was made of about four acres situated on the farm of Egbert Dederick, located as just described. The ground was prepared early last spring—ploughed, harrowed, picked free of stone—and laid out into beds four feet by twenty, which were planted with the seeds of White Pine, Scotch Pine, Norway Spruce and European Larch. Some planting was also done in rows, in which were used the seeds of Chestnut, Black Walnut, Red Oak, Pin Oak and Basswood. The soil is a clayey loam, somewhat gravelly. The land slopes to the northwest, and is partially protected from unfavorable winds by a belt of woods close by. A northwestern exposure may seem, at first thought, to be an unfavorable condition, but it has this advantage—that the plants will not thaw out too quickly after a late frost in the spring.

As most of the reforesting operations conducted by the Commission will be carried on in the Adirondack Preserve, a site for another and larger nursery was selected in Franklin County, at Saranac Inn Station. Here there is an open field of about seven acres, immediately adjoining the State Hatchery at that place, and sheltered on all sides by a standing forest. The soil is a sandy loam, which, under proper treatment, is best adapted to the growth of the coniferous species to be propagated there.

This nursery will have a capacity of 1,000,000 seedlings and transplants, and in time will furnish the entire stock necessary for the reforesting work of the Commission in the Adirondacks. Its close proximity to the railroad station will save considerable expense in the transportation of seedlings, while the employees

at the State Hatchery will at all times furnish protection in case of fire. The location is an ideal one, and no other place in the Adirondacks can be found that will so completely satisfy all the requirements. Work was commenced on the ground this fall, two teams and five men being employed in ploughing and preparing the soil. Next spring it will be laid out in beds four feet by twenty, in which will be planted seeds of White Pine and the native Adirondack Spruce, together with such other species as may be deemed advisable for experimental purposes.

The operation of this nursery will be dependent on a small annual appropriation by the Legislature—say \$450 or thereabouts. An additional sum may also be necessary, when it is well started, to provide for a fence and for a small house in which there should be a sleeping room for the forester in charge, and a loft where the supply of seeds can be prepared and safely stored. A tool shed will also form a convenient addition to the building.

The Legislature, at its last session, appropriated the sum of \$4,000 for undertaking reforestation operations and other work incidental thereto. Of this sum \$2,496.22 were expended in the purchase of seedlings and for labor in setting them out on the Lake Clear Plantation, and \$706.37 were paid out in establishing the Catskill Nursery. The latter amount included \$92.65, paid to J. M. Thorburn & Co., New York City, for seeds. The balance of the appropriation will be available for the preliminary work at the Saranac Nursery.

Instead of purchasing seed for its nurseries the Commission intends to obtain a supply from our native forests. Fresh, live seed will thus be secured; and the foresters, in collecting it, will have a good opportunity to familiarize themselves with that important branch of silvicultural work. As 1902 was not a seed year for the White Pine we were unable to collect any this fall, and so will have to purchase seed of this species for our nursery work next spring. An effort was made to find seed-cones of the White Pine in the Adirondacks, and Forester Knechtel made a trip to the Ontario forests for the same purpose, but without success in either locality.

Last season, however, was a seed year for the Adirondack Spruce, and so Forester Pettis, with the aid of a few laborers, collected a supply of cones which yielded ten bushels of these tiny seeds. Part of this supply will be used in the beds of the Saranac Nursery next spring; the rest will be available for some broadcast sowing on denuded lands, and also for free distribution in small quantities to any of our citizens who may wish to start small nurseries for forestry purposes, or for raising spruce-trees direct from the seed without transplanting.

As the details connected with the work of gathering spruce-cones and extracting the seed may be interesting to people who desire information as to the method employed, I append a report, made by Mr. Pettis, in which it is fully described.

Present Area of the Forest Preserve.

During the past year there has been some increase in the acreage of the Forest Preserve through acquisitions made by the tax sales of 1900, for which the period of redemption expired just before January 1, 1902, and also by purchases made under the last appropriation granted for that purpose. This appropriation was made in 1900, but, owing to delay in perfecting the titles, several tracts were not conveyed until after January 1, 1902, and hence they were not included in our printed land list or in the statement of acreage published in the report sent to the Legislature one year ago. The acreage as stated at that time was:

ADIRONDACK PRESERVE.*	
Counties.	Acres.
Clinton	20,105
Essex	231,764
Franklin	159,633
Fulton	21,426
Hamilton	578,340
Herkimer	146,733
Lewis	4,530
Oneida	6,637
St. Lawrence	34,683
Saratoga	11,588
Warren	108,283
Washington	2,129
Total	1,325,851

CATSKILL PRESERVE.	
Delaware	12,936
Greene	4,269
Sullivan	888
Ulster	64,237
Total	82,330

SUMMARY.	
Adirondack Preserve	1,325,851
Catskill Preserve	82,330
Total Forest Preserve	1,408,181

* To prevent confusion in the use of terms, it is well to remember that the Adirondack Preserve includes the State lands outside the Adirondack Park as well as the lands within the Park boundaries.

To the foregoing, the total Forest Preserve, must be added the acreage acquired in 1902, which is computed to be as follows:

	Acres.
Tax sale of 1900	15,513
Purchases in 1902	13,150
	<hr/>
	28,663
Less redemptions	158
	<hr/>
Total	28,505

Adding the latter amount to the acreage reported one year ago, the total acreage of the Forest Preserve on January 1, 1903, will be 1,436,686 acres.

Although the time for redemption of non-resident lands from the tax sale of 1900 expired in December, 1901, certain other lands, on which there may be a so-called occupancy, are entitled to a longer period of grace, and may be redeemed at any time within the six months following the service of the Comptroller's notice on the occupants. As the agents of the Comptroller served these notices last September and October, the title of the State to these parcels cannot be perfected until April, 1903, or thereabouts, the exact time varying with each lot according to the date when the agent filed his return, or affidavit of notice, in the office of the Comptroller at Albany. This leaves the exact acreage of the Forest Preserve somewhat in doubt just now, as there will still be numerous redemptions made under this provision of the law, amounting, perhaps, to 2,000 acres or more.

The total acreage just shown does not include the State lands in the towns of Altona and Dannemora, Clinton County, which are excepted in the law defining the Forest Preserve. These tracts, which were reserved for the use of the Dannemora Prison, contain 14,347 acres, and should be included in the Forest Preserve, even if the amendment making the necessary transfer contains some proviso that the care and custody of these forests shall remain in the Prison Department. The lands in the International Park, situated on the St. Lawrence River, in Jefferson and St. Lawrence Counties, are also omitted in computing the area of the Forest Preserve, although this property is placed by law under the care and management of the Forest Commission.

In my report, one year ago, I submitted a tabulation showing the classified acreage of the Adirondack Park as based on the returns of Foresters Bryant and Williams, who made a personal examination of all the townships included within

the park. (See pamphlet containing Seventh Annual Report of the Commission, January 30, 1902.) But within the past year the lumbermen and pulp-wood operators have cut and removed 501,765,565 feet of Spruce, Pine, Balsam and Hemlock, four fifths of which or more came from the forests within the "Blue Line," or park, boundaries. Some of this output was obtained also by a third cutting on park lands that were previously classified as lumbered. No supplemental work was undertaken to determine the area of virgin forest cut over last year, but it may be safely estimated at 70,000 acres. With the former tabulation revised, accordingly, we have for the classification at this date the following statement:

CLASSIFIED ACREAGE OF THE ADIRONDACK PARK.

JANUARY 1, 1903.

Class.	State.	Private preserves.	Individuals or companies.	Total.
Forest	455,415	257,186	375,453	1,088,054
Lumbered	592,630	368,115	780,394	1,741,139
Waste	10,275	22,483	15,793	48,551
Burned	14,617	5,301	23,247	43,165
Denuded	15,739	13,555	27,388	56,682
Wild meadows	9,961	380	12,188	22,529
Improved	4,642	6,239	90,099	100,980
Water	60,135	32,655	32,254	125,044
Total	1,163,414	705,914	1,356,816	3,226,144

The term "Lumbered," as used here, is intended to include lands that are not covered with virgin forest, and from which the lumbermen have removed the merchantable Spruce, Balsam, Pine and Hemlock, leaving the hardwood trees, which, as a general thing throughout the Adirondacks, constitute from sixty to seventy per cent of the forest. But it was difficult for the foresters to classify these lands exactly in every case, for on some tracts there was a sparse growth of small Spruce and Balsam that was available for a second or third cutting of young trees suitable for pulp-wood. Hence it is not claimed that the classification, so far as it relates to lumbered land, is strictly accurate or definite. Much of the land thus described will still yield from one to three cords of pulp-wood per acre, while here and there may be found small clumps of large Spruces which were not cut by the lumbermen because the unfavorable location of these trees made their removal unprofitable at that time.

Private Preserves.

In the Adirondack region there are sixty preserves, with an aggregate of 791,208 acres, held as private property by sportsmen's clubs or individuals. The boundaries of each preserve are posted at intervals of forty rods, with printed notices warning people that it is private land on which no trespassing, fishing or hunting will be permitted, the posting of such notices being required by the law authorizing the establishment of private parks or preserves. The club or individual is not necessarily the owner of the property; in some instances the land thus occupied and posted is leased, the exclusive fishing, hunting and camping privilege having been obtained through some such arrangement with the lumber company or person in whom the title is vested. Some of these preserves are situated, wholly or partly, outside the Adirondack park, and hence the acreage just mentioned exceeds that given in the table showing the classification of lands *within* the park.

Throughout all the private preserves the land is well wooded, and each contains some lake, pond or fishing stream. The forest, on some of these holdings, is a primeval one — untouched by axe or fire. On several of the larger preserves the owners are conducting lumbering operations; but as the cutting is done under a conservative and intelligent management, and is restricted to softwood species of medium diameter, a large revenue is derived from the property without impairing its capacity for future production. Then again there are clubs which own large tracts that have been lumbered, but as the logging was done fifteen years ago, or more, at a time when the lumbermen took the large timber of one species only, these forests retain much of their primitive condition.

The private preserves in the Adirondacks, with a slight exception, have been established within the last sixteen years — most of them within eleven years — and the comparatively sudden exclusion of the public from its old camping-grounds has provoked a bitter hostility on the part of the hunters, fishermen and guides who formerly ranged over this territory. The sportsman who returns to some favorite haunt only to find himself confronted with the words, "No Thoroughfare," turns back with a resentful feeling, while the guides, who were wont to conduct their patrons wherever game was plentiful, view with threatening looks the hired game-keepers that guard the forbidden lands.

On the other hand, the owners of the preserves point to the protection of the forests, fish and game afforded by them, and to the large number of guides and woodsmen to whom they furnish constant and lucrative employment. In 1899, the dry season in which forest fires were raging in the Adirondacks to an unusual extent, it was noticed that there were no fires on the private preserves, aside

from incipient ones that were extinguished before any serious danger was incurred. This was due to the large number of forest patrols employed by the owners of these tracts.

It is not necessary that the State should purchase these private holdings in order that the tree growth may be protected, for the owners can be relied upon to preserve the forest conditions that are so essential to the enjoyment of their property. The acquisition of these high-priced lands may be safely deferred until the rest of the Adirondack Park has been purchased. But the tenure of title to these private preserves is not permanent like that of the State Preserve; these properties change hands frequently; public sentiment is always gratified when any of this territory is opened to the people, and so it would be well if the State kept a fund on hand, available at all times, for the purchase of such tracts whenever any portion is thrown upon the market.

The ownership and acreage of the various preserves are as follows:

ADIRONDACK PRIVATE PRESERVES.

Acres.

ADIRONDACK CLUB.—McIntyre Iron Company, owner. Townships 45, 46 and 47, gores east and west of Township 47, and part of Township 27, Totten and Crossfield Purchase, in the western part of Essex County. Includes the larger portion of Mounts Marcy, Colden and McIntyre, and all of Mounts Santanoni, Henderson, Redfield, Allen and Adams, with Lakes Sanford, Henderson, Colden, Avalanche and Harkness . . .	59,300
ADIRONDACK LEAGUE CLUB.—Hon. Warren Higley, President. Townships 1, 2, 6 and part of 7, Moose River Tract, in the counties of Hamilton and Herkimer. Embraces twenty lakes and ponds, including Honnedaga, Little Moose and Woodhull Lakes . . .	79,172
ADIRONDACK MOUNTAIN RESERVE.—William G. Neilson, President. Township 48, Totten and Crossfield Purchase, in the central part of Essex County, part of the Roaring Brook Tract and Lot 68 of Townships 1 and 2, Old Military Tract. The boundary lines cross the summits of Mounts Marcy and Dix. The high mountains known as Noon Mark, The Gothics and Haystack are within its boundaries, as are also the two Ausable Lakes . . .	25,912
ADIRONDACK FORESTRY ASSOCIATION.—Gen. Hazard Stevens, Oscar B. Ireland and George E. Terry, Trustees. Part of Township 22, Totten and Crossfield Purchase, in the northern part of Hamilton County. Is near Long Lake, a part of the land adjoining the same . . .	4,358

	Acres.
ALTAMONT CLUB.—Union Bag and Paper Company, owner. Northern part of Township 8, Moose River Tract, in the western part of Hamilton County. Contains the Middle and West Canada and some other lakes. Altitude 2,348 feet above tide	4,595
AMPERSAND PRESERVE.—Santa Clara Lumber Company, owner. Part of Township 27, Great Tract 1, Macomb's Purchase, Franklin County. Mount Seward, with several lakes and ponds, are on this property . . .	32,407
ANTHONY PONDS.—Harper Brothers, owners. Part of Township 22, Totten and Crossfield Purchase, in the Northern part of Hamilton County . .	7,221
BOG LAKE CAMP.—Charles A. Tatum and Edmund C. Converse, owners. Part of Township 37, Totten and Crossfield Purchase, in the northern part of Hamilton County. Contains Bog Lake and Clear Pond . . .	5,618
BRANDRETH PARK.—Franklin Brandreth, Ralph Brandreth and Gen. E. A. McAlpin, owners. Township 39 and part of 42, Totten and Crossfield Purchase, in northern parts of the counties of Hamilton and Herkimer. Contains the headwaters of Raquette, Beaver and Moose Rivers, Brandreth Lake and several smaller lakes or ponds	27,298
CAMP ARBUTUS.—Archer M. Huntington, owner. Parts of Townships 27 and 28, Totten and Crossfield Purchase, in the western part of Essex County. Lake Arbutus (Ockerman Pond) is on this preserve . . .	1,699
CHILDWOLD PARK.—Henry G. Dorr et al., owners. Part of Township 6, Great Tract 2, Macomb's Purchase, in the southeastern part of St. Lawrence County. Includes Lake Massawepie	13,090
CAUGHNAWAGA CLUB.—William H. Clark, President. Part of Township 28, Totten and Crossfield Purchase, in the counties of Essex and Hamilton. Includes Catlin Lake	8,838
CUTTING PRESERVE.—Frank A. Cutting, owner. Part of Township 12, Great Tract 2, Macomb's Purchase, in the eastern part of St. Lawrence County	7,510
DE BAR MOUNTAIN PARK.—William Rockefeller, owner. Parts of Townships 12 and 15, Great Tract 1, Macomb's Purchase, in the central part of Franklin County. Contains De Bar Mountain and De Bar Pond (see also Everton Park and Rockefeller Preserve)	11,675
DEER LICK RAPIDS CLUB.—Part of Township 4, Great Tract 2, Macomb's Purchase, in the central part of St. Lawrence County. Contains Spruce Pond and other waters	7,500

Acres.

EVERTON PARK.—William Rockefeller et al., owners. Parts of Townships 11 and 12, Great Tract 1, Macomb's Purchase, in the central part of Franklin County. Stacey Mountain is on this tract (see also De Bar Mountain Park and Rockefeller Preserve)	20,000
FENTON GAME PRESERVE ASSOCIATION.—Leased land. Charles Fenton, Secretary. Parts of Townships 3, 4 and 5, John Brown's Tract, in the counties of Herkimer and Lewis. Contains Beaver, Francis and several other lakes or small ponds	60,000
FOLLENSBY POND PRESERVE.—Titus B. and Ferris J. Meigs, owners. Parts of Townships 25 and 26, Great Tract 1, Macomb's Purchase, in the southern part of Franklin County. Contains Follensby Pond	4,855
FOREST PARK AND LAND COMPANY.—William W. Durant, President. Part of Township 34, Totten and Crossfield Purchase, in the central part of Hamilton County. Contains Utowana and Eagle Lakes, and adjoins Blue Mountain Lake	4,838
"G" LAKE PRESERVE.—E. Z. Wright and John D. Collins, owners. Part of Oxbow Tract, in the southern part of Hamilton County. Includes "G" Lake	480
GRANSHUE CLUB.—Charles R. Holmes, President. Part of Township 7, Great Tract 2, Macomb's Purchase, in the central part of St. Lawrence County. Contains Long Pond	8,752
GRASSE RIVER OUTING CLUB.—Charles E. Brown, President. Part of Township 5, Great Tract 2, Macomb's Purchase, in the southern part of St. Lawrence County	5,520
HAMILTON PARK.—Hon. William C. Whitney, owner. Townships 23, 36, north half of 35, parts of Township 21 and of the triangle east of Township 23, Totten and Crossfield Purchase, in the northern part of Hamilton County. Contains Little Tupper, Round, Big Salmon Lakes and many other smaller lakes and ponds	71,281
HAMILTON LAKE PRESERVE.—John A. Starin, owner. Part of Township 1, Totten and Crossfield Purchase, in the central part of Hamilton County	3,202
HOLLYWOOD CLUB.—Dr. C. C. French, President. Part of Township 7, Great Tract 2, Macomb's Purchase, in the central part of St. Lawrence County. Contains Clear Pond	2,360

	Acres
HORSESHOE FORESTRY COMPANY.—Augustus A. Low, President. Parts of Townships 2 and 3, Great Tract 2, Macomb's Purchase, in the southern part of St. Lawrence County. Contains Horseshoe Lake, Lake Marian and many other lakes and ponds. The Bog River flows through this preserve	27,431
INLET CLUB PRESERVE.—Part of Township 9, Great Tract 2, Macomb's Purchase, in the eastern part of St. Lawrence County. Contains Whitney Pond and other waters	6,700
KAMP KILL KARE.—Hon. Timothy L. Woodruff, owner. Parts of Townships 5 and 6, Totten and Crossfield Purchase, in the central part of Hamilton County. Contains Lake Kora, formerly Sumner Lake . . .	1,030
KILDARE CLUB.—Ehrich Brothers, owners. Part of Township 9, Great Tract 2, Macomb's Purchase, in the eastern part of St. Lawrence County. Contains Amber and Jordan Lakes	8,536
KNOLLWOOD CLUB.—Louis Marshall et al., directors. Part of Township 21, Great Tract 1, Macomb's Purchase, in the southern part of Franklin County, on the northern shore of Lower Saranac Lake	450
LAKE PLACID CLUB.—Melvil Dewey et al., owners. Lands in town of North Elba, about Lake Placid and Mirror Lake	2,148
LAKE RESERVES.—Dr. William Seward Webb, owner. Part of Township 8, John Brown's Tract, in the eastern part of Herkimer County. Lands about Big Moose and the Fulton Chain of Lakes (see also Nehasane Park)	8,470
LITCHFIELD PARK.—Edward H. Litchfield, owner. Part of Township 25, Great Tract 1, Macomb's Purchase, in the southern part of Franklin County. Contains Lake Madeline (formerly Jenkins Pond) and several other bodies of water	12,427
LONG LAKE PRESERVE — Raquette Falls Land Company, owner. Part of Township 22, Totten and Crossfield Purchase, in the northern part of Hamilton County	2,200
LLOYD TRIANGLE.—Theodore Page et al., owners. Triangle in northwest corner of Township 41, Totten and Crossfield Purchase, comprising that portion of the township which is situated in Herkimer County. Contains Russian Lake and Merriam and Gull Ponds	3,600

Acres.

MASSAWEPIE CLUB.—Hon. A. P. Hepburn, owner. Part of Township 4, Great Tract 2, Macomb's Purchase, in the southern part of St. Lawrence County. Contains Brother Ponds and other waters	1,720
MAT-A-MEK PRESERVE.—Hon. Ashbel P. Fitch, owner. Parts of Townships 8 and 9, Old Military Tract, in the eastern part of Franklin County. Contains a part of Ragged Lake	1,854
MEACHAM LAKE PRESERVE.—Part of Township 15, Great Tract 1, Macomb's Purchase, in the central part of Franklin County. Contains East Mountain, Meacham Lake and several ponds	5,580
MOHEGAN LAKE CAMP.—J. Pierpont Morgan, owner. Part of Township 5, Totten and Crossfield Purchase, in the central part of Hamilton County. Contains Mohegan Lake	1,551
MOOSE POND PRESERVE.—Hon. George R. Finch, owner. Part of Township 26, Totten and Crossfield Purchase, in the southwestern part of Essex County. Contains Moose Pond and several other bodies of water	800
MOREHOUSE LAKE CLUB.—W. W. Mosher, President. Part of Arthurboro Patent, in the southwestern part of Hamilton County. Contains Morehouse Lake	1,500
NEHASANE PARK.—Dr. William Seward Webb, President. Parts of Townships 37, 38, 42 and 43, Totten and Crossfield Purchase, in the northern parts of Hamilton and Herkimer counties. Contains Lake Lila, Nehasane Lake and several other bodies of water, large and small	42,848
NORTH WOODS CLUB.—James Yalden, Secretary. Part of Township 16, Totten and Crossfield Purchase, in the southwestern part of Essex County. Mink Lake and several ponds are on this property	4,583
PAUL SMITH'S PRESERVE.—Paul Smith's Hotel Company, owner. Parts of Townships 18 and 21, Great Tract 1, Macomb's Purchase, in the southern part of Franklin County. Contains the St. Regis Lakes, Osgood Pond and other bodies of water	18,484
PINE LAKE CLUB.—Watson T. Dunmore, President. Part of Arthurboro Patent, in the southwestern part of Hamilton County. Contains Pine and Snowshoe Lakes	987

	Acres.
PLEASANT LAKE CLUB.—Thomas H. Wagstaff, President. Part of Glen, Bleecker and Lansing Patent, in the northwestern part of Fulton County. Contains Pleasant Lake	1,000
PLEASANT LAKE PRESERVE.—Part of Township 7, Great Tract 2, Macomb's Purchase, in the central part of St. Lawrence County. Contains Pleasant Lake and Blue Mountain	8,750
PUTNAM PRESERVE.—Dr. Charles P. Putnam, owner. Parts of Roaring Brook and North River Head Tracts, in the central part of Essex County. Contains Twin Ponds and several other small bodies of water	2,960
READ AND STRONG PARK.—Part of Township 25, Great Tract 1, Macomb's Purchase, in the southern part of Franklin County. Contains Mount Morris and Little Simon and McBride Ponds	7,375
ROCKEFELLER PRESERVE.—William G. Rockefeller, owner. Townships 16 and 17, Great Tract 1, Macomb's Purchase, in the central part of Franklin County. Contains Follensby Junior, Wolf and McDonald Ponds and several other bodies of water (see also De Bar Mountain and Everton Parks)	52,335
SABATTIS PARK.—Charles R. Christy, owner. Part of Township 37, Totten and Crossfield Purchase, in the northern part of Hamilton County. Contains Bear Pond and some other small bodies of water	1,633
SAGAMORE PARK.—Alfred G. Vanderbilt, owner. Part of Township 6, Totten and Crossfield Purchase, in the central part of Hamilton County. Contains Lake Sagamore (formerly Shedd Lake)	1,530
SANTANONI PARK.—Hon. Robert C. Pruyn, owner. Part of Townships 27 and 28, Totten and Crossfield Purchase, in the western part of Essex County. Contains Newcomb Lake and several ponds	11,205
SARANAC CLUB.—Jonathan J. Broome, President. Part of Township 23, Great Tract 1, Macomb's Purchase, in the southern part of Franklin County, on the old Bartlett Carry, between the Upper and Middle Saranac Lakes	267
STILLWATER CLUB PRESERVE.—J. H. Rushton, Secretary. Part of Township 6, Great Tract 3, Macomb's Purchase, in the central part of St. Lawrence County. Contains Cranberry Pond and many other bodies of water	20,000



AN ADIRONDACK INTERIOR.



ADIRONDACK COTTAGE OF THE LATE PRESIDENT HARRISON.

	Acres.
UPPER SARANAC ASSOCIATION.—Dr. Samuel B. Ward, President. Part of Township 20, Great Tract 1, Macomb's Purchase, in the southern part of Franklin County, at the north end of Upper Saranac Lake	2,751
VILAS PRESERVE.—E. A. Carpenter, owner. Parts of Townships 9 and 12, Great Tract 2, Macomb's Purchase, in the eastern part of St. Lawrence County	18,075
WILDERNESS PARK.—W. S. De Camp, owner. Parts of Townships 1 and 7, John Brown's Tract, in Hamilton and Lewis Counties. Contains Nick's, Blackfoot and Gibbs Lakes and several ponds	29,567
WILMURT CLUB.—Hon. Titus Sheard, President. Part of Arthurboro Patent, in the southwestern part of Hamilton County. Contains Wilmurt Lake	1,655
ZACK LAKE PRESERVE.—Raquette Falls Land Company, owner. Part of Township 27, Totten and Crossfield Purchase, in the western part of Essex County. Zack Lake is on this preserve	1,725
Total acreage	791,208

The total area of the private preserves as given here is much less than that shown in the list published by the Forest Commission in its annual report for 1893. This decrease is due to large sales made to the State and to lumber companies. Since 1896 the State has purchased 75,000 acres from the Nehasane Park Association; 35,932 acres from the Adirondack League Club, and 30,000 acres from the owners of the Santa Clara Preserve.

In addition to the preserves mentioned in the foregoing list, there is a large amount of forest property in the Adirondacks composed of small holdings—from five acres to one hundred acres each—on which cottages, or “camps,” as they are called, have been erected. These summer residences, with their pretty boathouses and other buildings, are often located at sightly points on the lakes—particularly the Raquette, Saranacs and St. Regis—where they form a never failing source of interest to the tourist, as they represent large expenditures of money and are models of good taste combined with solid comfort. They furnish employment at high wages for a large number of people—“house guides,” servants and men on private launches—and contribute in various other ways to the prosperity of the region. Together with the “camps” on the larger private preserves, there are at present 419 of these summer residences in the Adirondacks, costing from

\$5,000 to \$100,000 each, in which the investment for buildings, exclusive of land, amounts in the aggregate to \$3,846,500.

If there are any to whom these figures may appear unduly large, their attention is respectfully called to the beautiful and costly summer homes, near Raquette Lake, owned by Mr. J. P. Morgan, Mr. A. G. Vanderbilt, Hon. T. L. Woodruff and the late Mr. Collis P. Huntington; to the forest villas on the St. Regis Lakes of Hon. Whitelaw Reid, Mr. F. W. Vanderbilt and Mr. H. McK. Twombly; to the expensive and tasteful "camps" on Upper Saranac Lake belonging to Hon. L. P. Morton, Mr. Isaac Seligman, the Messrs. Swenson, Mr. Julius S. Bache, Dr. L. E. Holt and Mr. D. H. Kahn; to the buildings of the Knollwood Club on Lower Saranac; the numerous fine cottages of the Adirondack League Club on Little Moose, Honnedaga and the Bisby Lakes; the houses of the Saranac Club on the Bartlett Carry; the large number of beautiful cottages at Lake Placid and Keene Valley, and the extensive buildings on the private preserves of Hon. Robert C. Pruyn, Dr. W. Seward Webb, Mr. William Rockefeller, Gen. E. A. McAlpin and Mr. A. A. Low.

Adirondack Summer Business.

The business done each season by the hotels and boarding-houses in the Adirondacks contributes largely to the development and prosperity of Northern New York, fairly approaching in its magnitude that of the great industries which are dependent on the forest product of that region. In the management of this business employment is furnished to thousands of people, trade is stimulated by the large purchases of supplies, building operations increase the demand for skilled labor, while the railroad and steamboat lines reap the benefits accruing from the large passenger and freight traffic. Of more importance, however, far greater in its humane aspect than mere commercial advantages, are the sanitary benefits afforded by the Adirondack forests to the thousands who there find relief from disease and enjoy a new lease of life. The healthful climate is due largely to the pure air, which, carried by mountain winds over great forest areas, is freed from dust, smoke and miasmatic influences, while in its course it is charged with balsamic exhalations that carry healing to the lungs of invalids.

The statistics published in the annual reports of the Adirondack Cottage Sanitarium show a remarkable percentage of cures effected in patients suffering from incipient consumption; and a large proportion of the population in some of the Adirondack villages is composed of people who enjoy comparatively good health in that climate, although they could not live long elsewhere. Of this class many find employment in various vocations, while others, whose incomes will permit,

maintain a permanent residence there without engaging in any business or occupation.

I submit herewith a carefully prepared table showing the capacity of the hotels and boarding-houses in the various localities throughout the Adirondack region, compiled from their advertisements, in which each proprietor states the number of people that can be accommodated, this advertised capacity being cut down in many instances to better suit the facts in the case. It does not include the occupants of private camps and sanitariums:

ADVERTISED CAPACITY OF ADIRONDACK HOTELS AND BOARDING-HOUSES.

COMPILED BY LOCALITIES.

CLINTON COUNTY.

Bluff Point	40
Chateaugay Lake (Upper)	385
Chazy Lake	85
Cliff Haven (Champlain Assembly)	875
Hotel Champlain	525
Redford	223
Silver Lake	20
Total	2,153

ESSEX COUNTY.

Aiden Lair	50
Ausable Forks	233
Bloomington	299
Blue Ridge	20
Boreas River	24
Cascade Lakes	85
Chilson Lake	55
Crown Point	237
Elizabethtown	686
Elk Lake	30
Essex	102
Jay	191
Keene Centre	65
Keene Heights	315
Keene Valley	525
Keeseville	280

EIGHTH REPORT OF THE

ESSEX COUNTY — (*Concluded*).

Lake Placid	2,259
Lewis	54
Loch Muller	45
Minerva	65
Newcomb	55
New Russia	68
North Elba	170
North Hudson	70
Olmstedville	34
Paradox Lake	35
Port Douglas	65
Port Henry	191
Port Kent	41
Pyramid Lake	95
Ray Brook	45
Schroon Lake	555
(See also Schroon Lake, Warren County.)	
Schroon River	80
South Schroon	35
Underwood	45
Wadham's Mills	49
Westport	391
Willsboro	20
Wilmington	135
Total	7,799

FRANKLIN COUNTY.

Axton	15
Chateaugay Lake (Lower)	65
Duane	95
Gabriels	48
Goldsmith's	28
Harriettstown	70
Lake Clear	185
Loon Lake	385
McCollom's	45
Meacham Lake	85
Mountain View	95
Onchiota	35
Paul Smith's	475

FRANKLIN COUNTY—(Concluded).

Rainbow Lake	120
Raquette River	35
St. Regis Falls	40
Saranac Lake (Upper)	589
Saranac Lake (Middle)	85
Saranac Lake (Lower)	550
Saranac Lake (Village)	1,138
Spring Cove	65
Tupper Lake	188
Tupper Lake (Junction)	172
Vermontville	18
Total	4,626

FULTON COUNTY.

Canada Lakes	245
Caroga Lakes	55
Northville	75
Stratford	35
Total	410

HAMILTON COUNTY.

Blue Mountain Lake	625
Cedar River	40
Chain Lakes (Township 18)	35
Fulton Chain (Fourth Lake)	295
Fulton Chain (Seventh Lake)	65
(See also Fulton Chain, Herkimer County.)	
Hope	30
Indian Lake	85
Indian Lake (Village)	35
Lake Pleasant	360
Long Lake	460
Long Lake (West)	35
Morehouseville	55
Piseco Lake	45
Raquette Lake	195
Wells	35
Total	2,395

EIGHTH REPORT OF THE

HERKIMER COUNTY.

Beaver River	80
Big Moose	355
Bisby Lakes	85
Clearwater	35
Fulton Chain	886
(See also Fulton Chain, Hamilton County.)	
Fulton Chain Station	45
Honedaga Lake	110
Little Moose Lake	205
McKeever	45
Moose River Chain	85
Moose River (North Branch)	20
Nobleboro	30
Northwood	25
Old Forge	225
Otter Lake	35
Twitchell Lake	55
Wilmurt	34
Total	2,415

LEWIS COUNTY.

Brantingham Lake	85
Croghan	35
Harrisville	115
Lake Bonaparte	110
Number Four (Fenton's)	130
Oswegatchie River	35
Total	510

ONEIDA COUNTY.

Otter Lake	45
Trenton Falls	90
White Lake	45
Total	180

ST. LAWRENCE COUNTY.

Benson Mines	35
Childwold	325
Cranberry Lake	265
Gale's	55
Hollywood	45
Kildare	30

ST. LAWRENCE COUNTY—(*Concluded*).

Newton Falls	85
Piercefield	43
Sevey	25
Star Lake	315
Total	1,223

WARREN COUNTY.

Brant Lake	195
Chestertown	382
Friends Lake	220
Horicon	33
Johnsburgh	28
Loon Lake	25
Luzerne (Hadley)	381
North Creek	80
North River	65
Pottersville	39
Riverside	15
Schroon Lake	320
(See also Schroon Lake, Essex County.)	
Stony Creek	85
Thirteenth Lake	25
Thurman	62
Warrensburgh	196
Total	2,151
Lake George	3,640

SUMMARY.

Clinton County	2,153
Essex County	7,799
Franklin County	4,626
Fulton County	410
Hamilton County	2,395
Herkimer County	2,415
Lewis County	510
Oneida County	180
St. Lawrence County	1,223
Warren County	2,151
Lake George	3,640
Total	27,502

In August the hotels and boarding-houses, with few exceptions, are filled to their utmost capacity, and the total just given (27,502) indicates closely the number of guests in the Adirondacks at that time. With these figures must also be kept in mind the equally large capacity of the private "camps" and cottages, each occupied during the season by some family and its guests. But the summer boarders are coming and going from June to September, staying, on an average, about two weeks each. In the White Mountains an exhaustive census of the summer people and the hotel business shows that sixty-two per cent of the arrivals remained less than one week.* A careful estimate of the total number of summer visitors from the beginning to the end of the season, as reported by the Adirondack hotels and boarding-houses, to which are added the occupants of private "camps," shows that 193,681 people went there last season for recreation and health. This also includes the sportsmen who went there in May for the fishing, and in October or November for deer shooting.

That this number is not an overstatement is evident from the information kindly furnished this office by the general passenger agents of the New York Central and the Delaware and Hudson Railroads, from which it appears that 225,000 passengers were carried on the Adirondack divisions during the summer season. These figures do not represent the entire passenger traffic during that period, but the difference obtained by deducting from the total summer traffic an amount equal to that of the winter months, the difference evidently showing the number of summer boarders, hotel employees and sportsmen on their way to and from the woods.

The following statistics are based on the returns made to this office by each hotel and boarding-house in the Adirondack region:

VOLUME OF ADIRONDACK BUSINESS.

Capital invested in buildings, furniture, boats, horses, carriages, etc., *not including land*:

Hotels and boarding-houses	\$7,037,923
Private "camps" and cottages	3,846,500
Total	<hr/> \$10,884,423

* "The Summer Season in New Hampshire." Special Report by the State Bureau of Labor. L. H. Carroll, Commissioner, Manchester, N. H. Public Printer, 1900.

Number of male help employed (clerks, porters, cooks, bell-boys, musicians, boatmen, stable- men, drivers, laborers, etc.)	3,461	
Number of female help employed (waitresses, chambermaids, cooks, laundresses, musicians, telegraph operators, typewriters, etc.)	9,846	
		13,307
Total wages paid		\$993,530
Cash received for board, carriages, boats, etc.		5,213,210
Cash received for railroad and steamboat fares		875,000
Total number of hotel guests, boarders, fishermen, hunters and occupants of private "camps" or cottages		193,681

It is not claimed that the foregoing figures are absolutely correct, as the statements made by some of the hotel proprietors and boarding-house keepers, in filling out their returns, were at times somewhat confused and indefinite; but they will give a fair idea of the stream of wealth that flows into Northern New York each summer, conducing so materially to the development and prosperity of the State. It is also well to note that a good share of the patronage comes from people who reside in other States, and that the profits derived from their business furnish a revenue that is especially valuable in that respect. Hence the continuance of this business, with all its accruing benefits, is dependent on the preservation of the Adirondack forests.

The average wages received by the employees, and the average amount paid by guests, may seem too small unless one keeps in mind the short season, during which it is necessary for the Adirondack hotels to employ their help, and the short stay of a very large proportion of the summer boarders. In connection with the preparation of these statistics the following letters, containing interesting and valuable information, were received:

THE DELAWARE AND HUDSON COMPANY.
OFFICE OF THE GENERAL PASSENGER AGENT.

ALBANY, N. Y., *December 24, 1902.*

COL. WILLIAM F. FOX, *Superintendent State Forests, Albany:*

DEAR SIR.—A careful examination of our passenger traffic statistics, made with reference to ascertaining, as nearly as possible, the number of passengers carried and the revenue derived from strictly pleasure and recreation travel to the Adirondack region (in which are included Lake George and Lake Champlain).

during the season of 1902, discloses that this traffic approximates closely to 175,000 passengers and \$475,000 passenger revenues to the company. We estimate that about sixty per cent of this traffic originates in other States. These estimates do not include the freight and express companies' earnings.

It is apparent to those who have kept in touch with the remarkable development of the health and pleasure resort region of Northern New York during the past ten years that the State has in that country an asset of almost incalculable value to its citizens in its power to attract revenues to its farmers, its merchants and its hotel and transportation interests. As one who, in connection with his avocation, has made a life study of the best means of developing health and pleasure travel resorts, I would suggest that the best investment the State could make in this direction would be the construction of a model system of highways through its Adirondack domain, affording means of easy communication between points of interest to the tourist somewhat after the policy adopted in Switzerland, in the Austrian Tyrol, in the mountainous tourist region of Norway and through the White Mountains of New Hampshire. If this were done, it would result in a great increase of travel, not only from other States, but from Europe as well, and I believe that the roads could be properly maintained by tolls without further expense to the State than their initial cost.

Very respectfully yours,

J. W. BURDICK,

General Passenger Agent.

NEW YORK CENTRAL AND HUDSON RIVER RAILROAD COMPANY,
GEORGE H. DANIELS, GENERAL PASSENGER AGENT,
GRAND CENTRAL STATION.

NEW YORK, *December 23, 1902.*

Subject: New York State Summer Resort Business.

COL. WILLIAM F. FOX, *Superintendent State Forests, Albany:*

DEAR SIR.—Mr. Burdick wrote me recently in reference to your call upon him for information which you desired to embody in your annual report, covering the value of summer and pleasure travel to the Northern New York resorts.

Our auditor has made an examination of our reports and approximates the following figures, covering business for three months of the summer :

	Passengers.	Railroad fares.
Adirondack section	100,000	\$400,000
Thousand Island section	50,000	160,000
Niagara Falls	160,000	170,000
Catskill Mountains	85,000	155,000
Total	395,000	\$885,000

This information, of course, can only be given approximately; but this will afford an opportunity for the people to get some idea of the development of the Adirondacks and other resorts, and what it means to the transportation and hotel interests in the State at large. A large amount of this business comes from outside the State.

The aggregate number of tourists carried by all lines, and the amount of money spent by them for railroad fares, hotel and boarding accommodations and incidental expenses, amounts to large revenues to the transportation lines and residents of the State. It is worthy to be recognized as a business, and its possibilities of development should command attention.

I shall be glad to give any further information desired in connection with this question, and shall be pleased to receive a copy of your report after it is printed.

Very truly yours,

GEORGE H. DANIELS,

General Passenger Agent.

The large amount of summer business done in the Catskill region, as indicated by the figures in Mr. Daniels's letter, is also worthy of consideration in discussing the great advantages accruing to our State from its forest districts, but through lack of time I was unable to include in this report any details relating to the hotels and boarding-houses in that region.

Forest Product for 1901.

As customary in the annual report, I include here a statement showing the amount of timber cut for various purposes in the Adirondack and Catskill forests during the year 1901. Considerable time is required for collecting the returns from the different lumber and pulp mills, and as such returns cannot well be made until the year has expired, the publication of these statistics is necessarily delayed until the next annual report of the Commission.

The figures for the year 1901, as compiled from the reports made to this office by the various lumber, wood-pulp, cooperage and wood-acid operators, show a slight increase in the amount of timber cutting in the Great Forest of Northern New York when compared with those of the preceding year, but as compared with 1898 the output is nearly the same. While the total production has not varied much of late years, there has been a continuous increase in the amount of Spruce used for pulp-wood. The returns also show an increase in the cutting of hardwoods throughout the Adirondacks, due, in part, to the recent erection of cooperage and wood alcohol plants.

The amount of Spruce cut for pulp-wood, as stated here, contains considerable Balsam and some Poplar; but as the Balsam is mixed with the Spruce in the log

drives and shipments by rail it would be very inconvenient for the operators to determine the amount of each, and hence no distinction was made in their returns. The amount of Spruce reported by the sawmills also contained some Balsam, but the proportion of the latter, cut into lumber, is much less than that used by the pulp-mills.

OUTPUT OF ADIRONDACK FORESTS.

	1901.	Ft. B. M.
Spruce (sawmills)		154,430,030
Spruce (pulp-mills)		237,483,126
Hemlock		63,809,318
White Pine		46,043,091
Hardwoods (sawmills)		36,452,529
Hardwoods (cooperage, chemicals, etc.)		6,036,804
Total		544,254,898
Shingles		32,628,500
Lath		51,528,400

OUTPUT OF CATSKILL FORESTS.

	1901.	Ft. B. M.
Spruce		2,578,000
Hemlock		18,825,358
White Pine		9,185,346
Hardwoods		27,314,452
Wood for chemicals (95,124 cords)		52,223,076
Wood for excelsior (3,800 cords)		2,086,200
Wood for furniture (1,510 cords)		828,990
Wood for pulp (3,800 cords)		2,086,200
Total		115,127,622
Shingles		5,519,750
Lath		4,867,800

The hardwoods used in the Catskill sawmills consist mostly of Chestnut and Oak—species which do not grow on the Adirondack plateau. The hardwood output of the latter region is composed of Yellow Birch, Beech and Maple, with a small amount of Basswood, Cherry and Elm.

Some of the furniture factories in the Catskills made their returns in feet

(board measure) and some in cords. When the amount was expressed in feet it was tabulated with the sawed lumber, but if in cords it was placed with the items of that class.

The total output of the Adirondack and Catskill forests is :

	Ft. B. M.
Adirondacks	544,254,898
Catskills	115,127,622
Total	659,382,520
Shingles	38,148,250
Lath	56,396,200

But the forest product of the Empire State is not confined to the output of the Adirondack and Catskill regions. There is a large area of primitive forest in Lewis County, west of the Black River Valley, in the towns of Osceola, Montague and Highmarket, which, owing to its isolated situation, is not considered as a part of the Adirondack district. A wide area of productive woodland still remains in some of the counties on the southern tier, especially in Cattaraugus and Chautauqua, while throughout all the farming districts there are scattered belts of timber that furnish a stock of logs, principally hardwoods, for many small mills. Hence the entire forest product of New York is considerably greater than that reported here from the Adirondack and Catskill counties. Any consideration of the latter two districts would thus be misleading as to the total extent of the forest wealth and resources of the State.

Hitherto this Department has made no effort to secure accurate returns from the sawmills outside the Adirondack and Catskill counties, this information being obtainable at intervals from the report of the United States Census. From the latter it appears that the total forest output of New York for the year 1899 was:

	Ft. B. M.
Spruce	255,939,000
Hemlock	314,191,000
White Pine	122,756,000
Other conifers	5,950,000
Hardwoods	207,976,000
Spruce (pulp-mills)	199,520,325
Poplar (pulp-mills)	17,630,586
Other species (pulp-mills)	5,196,834
Total	1,129,159,745

The pulp-wood in the foregoing table is given in the census returns as 363,425 cords of Spruce, 32,114 cords of Poplar and 9,466 cords of other species, which are converted here into feet on a basis of 549 feet (board measure) per cord. As the total output of the Adirondack and Catskill counties in 1901—the largest in any of the last ten years—amounted to 659,382,520 feet, it leaves 469,777,225 feet as the lumber output of the outlying counties.

Aside from the Adirondack and Catskill forests, it is doubtful if the woodlands of this State produced 469,777,225 feet of lumber in 1899, and we are forced to the conclusion that the returns for this industry, as made to the Census Bureau by its agents, included some overestimates.

Be this as it may, however, the information contained in the Twelfth Census relating to the lumber and pulp industry of New York is extremely interesting, giving all the statistics pertaining to forest products with a wealth of detail that makes the report valuable to every one interested in these lines of business. From the censuses of the preceding years it appears that the lumber output of New York passed its maximum years ago. In 1850 it was the leading State of the Union in this industry; in 1860 it was passed by Pennsylvania, and in 1900 it dropped to twelfth place on the list. But it still retains its supremacy in the manufacture of wood-pulp and paper, having a long lead of any other State in the magnitude of these industries.

Partition of Lands.

The printed land-list, published in 1901, is an octavo of 367 pages, containing a schedule of the 5,934 different lots or tracts constituting the Forest Preserve. In this list there are sixty-one parcels, amounting to 16,088 acres, in which the State has an undivided interest, or joint ownership, amounting to 7,478 acres. In the past year a partition of interest was effected in two cases, the land being divided so that the State received a tract of equal acreage and value, set off by itself, and in which the State has the sole ownership.

One of these partitions was made with the Raquette Falls Land Company with whom the State owned an undivided ten forty eighths in certain lots situated in Townships 25 and 26, Totten and Crossfield Purchase, Essex County; the other was made with Charles A. Darby, with whom the State owned an undivided one half interest in Lot 85, Paradox Tract, Essex County. Before making any division the lands were inspected by Forester Sterling, who filed in the office a report in which he described fully the amount and kinds of standing timber, and submitted maps showing the location and topography. As Lot 85 is situated on

Paradox Lake, a division was made which gave the State half of the shore-line as well as its share of the land and timber.

It is extremely desirable that a partition of interest should be made in all the lands of the Forest Preserve where the State has a joint ownership, for the joint owner has partnership rights which, if exercised, would conflict with the forestry laws and the management of the public interest. The parties who own these lands jointly with the State seldom ask for a division of the property, preferring, as a general thing, to let the titles remain as they are. If a division of the lands is to be effected, it will be necessary for the Commission to authorize its attorney to commence partition suits as provided for in the Forestry Law; or, what would be better, obtain from the Legislature an appropriation sufficient to purchase these outstanding interests.

Loan Commission Lands.

Another source of annoyance in the care of the Forest Preserve are the lands acquired by the State through foreclosure of mortgages made to the Commissioners of the United States Loan. Perhaps some explanation may be proper here in relation to this class of lands, showing how they were acquired and why they are included in the Preserve.

In 1836, the United States being free from debt and with a large surplus in its treasury, apportioned this surplus among the various States in proportion to their representation in Congress, retaining \$5,000,000 in the Government Treasury. These moneys were given to the several States as a loan, to be repaid when called for.

The Legislature of New York then enacted (Chapter 150, Laws of 1837) that the money thus received should be distributed to the various counties according to population; that the Governor should appoint two commissioners in each county who should loan these funds "on mortgage on improved land" in sums not exceeding \$2,000, and for periods not longer than five years; that in case of foreclosure the property should be sold to the highest bidder, and that in case no bidder appeared it should be bid in for the State by the commissioners.

Under the provisions of this law the State acquired and now owns parcels of land, containing in the aggregate 10,488 acres, situated in the Adirondack and Catskill counties. The loan commissioners have the right, under the law of 1837, to sell these lands again, and acting under its provisions they sold last year several lots in Ulster County that are borne on the Comptroller's books and on the land-list of the Forest Commission.

Although the law of 1837 confines these loans to improved property, many of the farms thus mortgaged included considerable wild land, wood lots and areas of forest, the cleared ground on which the buildings stand forming in some instances only a small portion of the acreage. In some cases the farms have been abandoned, and the parts that were cleared have become overgrown with small trees or bushes.

For instance, take Lot 375, Township 11, Old Military Tract, in the town of St. Armand, Essex County. This lot contains 160 acres. About thirty-five acres were cleared at one time and a house built, but the farm was abandoned and the clearing has grown up largely to brush and scrubby trees. The rest of the tract is covered with a hardwood forest, the Spruce and other softwoods having been cut out by lumbermen several years ago. Only a few acres were cultivated by the last occupant, who also cut some wild hay on this lot. The State acquired title to this land in 1893 through foreclosure of a mortgage, and has paid taxes on it since that time. It is assessed to the State on the tax-roll of St. Armand for this year; is borne on the Comptroller's books as part of the Forest Preserve; is on the published land-list of the Forest Commission, and is colored red on the Adirondack map to indicate the ownership. And yet the loan commissioners of Essex County leased this lot on January 14, 1892, to one Joseph Fortain for five years, at an annual rental of twenty-five dollars.

The law defining the Forest Preserve provides that it "shall include the lands owned or hereafter acquired by the State" in sixteen specified counties, with certain exceptions, among which are: "*Lands not wild lands* acquired by the State on foreclosure of mortgages made to loan commissioners." This would indicate that the forest areas and "wild lands" thus acquired belong to the Preserve; otherwise the exception is meaningless and unnecessary. Still, where one of these lots is part clearing and part forest, it is difficult to determine its status at present and whether it is within the jurisdiction of your Commission.

To avoid conflict with any loan commissioners as to the management of such properties I would respectfully suggest that a survey be made of each, and that a map of the same be filed with the Comptroller, showing just how much is wild or forest land; that the portion so described be set off in each case and added permanently to the Preserve, and that the legislation necessary to effect such an arrangement be obtained. If this is deemed unadvisable or impracticable, it would be well to amend the clause containing the exception quoted so as to leave all these lands in the care and custody of the loan commissioners.

It may be well to add here that the peculiar class of lands discussed in the preceding paragraphs should not be confounded with the bonded lands on our land-list, title to the latter having been acquired from a different source.

Foresters' Reports.

Though centuries old, forestry is a science which is a progressive one. Modern inventions and mechanical appliances are developing improved methods for exploiting our woodlands, while the researches of foresters and horticulturists are evolving new lines of silvicultural work.

The American Chestnut is a forest tree that has always furnished merchantable timber; and now, through scientific experiment, its desirability as a nut-bearing species has been enhanced by the propagation of varieties which bear fruit of large size and superior quality, thereby giving an increased value to a species which is so common in the Catskill forests and other parts of New York. My attention having been called to the successful efforts made in a neighboring State for the cultivation of this species and the improvement of its nut-bearing capacity, Forester Sterling was directed to make an extended tour through the localities where Chestnut groves have been established. He was instructed to obtain all possible information as to the result of this experimental work, to secure photographs of the plantations, and to make a written report to this office.*

The Forestry Department of the Commission has received several letters from citizens soliciting information regarding the management of their woodlands, or advice as to the treatment of trees which were failing, or dying, from some unknown cause. In some of the latter cases, when the regular business of the Department would permit, a forester was detailed to visit the place, examine the trees, give such information or advice as the circumstances seemed to demand, and make a written report on the same to the Superintendent. As some of these special reports contain information and suggestions that may be of benefit to others, I append here one made by Forester Knechtel regarding the destruction of shade-trees in Flushing and Port Jefferson, Long Island, where he had been sent in response to demands on the Department for expert assistance.

All of which, together with the subreports of the foresters just referred to, are respectfully submitted.

WILLIAM F. FOX,

Superintendent State Forests.

*This article, "Chestnut Culture in the Northeastern States," by E. A. Sterling, was published in the supplementary volume of the Seventh Report.

Special Report of Forester Knechtel on Dead and Diseased Trees in Flushing and Port Jefferson, Long Island.

ALBANY, N. Y., *December 9, 1902.*

COL. WILLIAM F. FOX, *Superintendent State Forests, Albany:*

SIR. — On the twenty-eighth of last March I visited Flushing, N. Y., in accordance with your instructions, to determine, if possible, the cause of the death of trees reported to the Forest Commission by the Good Citizenship League of that place. Dr. E. P. Felt, State Entomologist, whom I chanced to meet at that time in New York City, very kindly accompanied me.

The shade-trees of Flushing are remarkable for their number, beauty, size and variety. One hundred and forty species, native and foreign, together with numerous varieties, have been counted within the limits of the place. For two centuries its trees have been the pride of the old town.

Nurseries founded there in early times have facilitated the planting of trees. The horticultural interests of America were first established commercially in Flushing, although the arts of budding and grafting had been previously practiced by the French Huguenot immigrants. In 1737 William Prince began a nursery and garden which, in 1860, contained 113 acres. The Civil War, however, curtailed the patronage to such an extent that the business was ruined and the lands were afterwards appropriated by the village for building purposes.

In the year 1790 James Bloodgood founded the nurseries bearing his name, now under the very successful management of Messrs. Keene & Foulk. These are the oldest nurseries in continuous existence in the country. For nearly half a century they were conducted by Mr. Joseph H. King, one of the most enterprising citizens in the town.

The Parsons Nurseries were established in 1840, and, with the others mentioned, have made Flushing known to horticulturists all over America.

To the nurseries must be attributed much of the taste for rural adornment so characteristic of the place. Besides the native species of trees are to be found the Cedar of Lebanon, the Chinese Taxodium, the Southern Cypress, the Paulownia, Japanese Maples, and many other nursery varieties.

Some of these trees are very noted. A stone near the sidewalk on the west side of Bowne avenue, opposite the Bowne House, marks the site where stood two famous Oaks called the "Fox Oaks." Under these trees George Fox, the founder

of the Society of Friends, held a "glorious and heavenly meeting," as he himself described it. They measured respectively thirteen feet and twelve feet four inches in circumference. One of them fell in the year 1841 and the other in 1863. In Washington Place stands a Weeping Beech which Sir Joseph Hooker pronounced the largest specimen of its kind in the world. On Parsons avenue, just south of Broadway, there is perhaps the finest row of Taxodiums in the United States. A very fine Cedar of Lebanon stands in the dooryard of the Prince House, on Bridge street and Lawrence avenue. The streets are beautiful with great Oaks, Tulips, Maples and Lindens.

Like men, trees live, grow old and die. Many of the trees in Flushing are old, some being more than 100 years of age. To be sure, in the forests trees may be found that have lived 500 years; but in a city, where so many injurious influences are at work, a tree does well if it lives a century. Robert Hartig, a German writer upon plant pathology, does not admit that a tree dies from internal natural causes. The cause of death, he asserts, is always to be found in unfavorable influences. Be this as it may, when the decay of trees becomes epidemic it is evident that it must be attributed to external causes. A large number of the Flushing trees died in the years 1901 and 1902, and it was on this account that the request came to the State Forest Commission from the Good Citizenship League for an investigation.

On examining the trees of the place many species were found to have on the bark numerous cocoons of the white-marked tussock moth. These cocoons are of a dirty gray color, and each bears upon it a glistening white object which, upon close examination, is found to consist of numerous eggs partly covered by white spittle-like matter. Sometimes this mass consists of 700 eggs. The eggs hatch about the middle of May, and the young caterpillars scatter over the tree and feed upon the leaves, often causing entire defoliation. A full description of the insect and its habits, accompanied by colored illustrations, can be found in an article by Dr. Felt in the Fourth Annual Report of the Forest, Fish and Game Commission.

Evidence of a great ice storm, which occurred in this locality last February, was everywhere visible. Very many trees were broken, some being utterly destroyed. Along the streets were large piles of rubbish, consisting of limbs broken off by the storm.

On examining these branches it was found that the leopard moth had also been active among the trees. This is considered probably the worst insect enemy of the shade-trees in the vicinity of New York City. The eggs are deposited in crevices of the bark. On hatching the young caterpillars enter the twigs, usually

at the base of a bud, and tunnel along the pith, eating away the wood here and there almost to the bark. As the caterpillars increase in size they attack the larger limbs and even the trunk of the tree.

The curiously shaped bags, or larval cases, of the bag-worm were also found suspended from some of the trees. This insect, in the adult stage, is a moth. The larvæ are caterpillars, which are leaf-feeders, attacking many species of trees, but more especially the Arbor-vitæ and the Red Cedar.

There is need of more definite observation to determine how long trees will live when defoliated each year by insects. It is well known that they will endure defoliation once without serious injury. Certain trees in Flushing, which were pointed out as having been entirely stripped of leaves last year, were in August of this year in the most luxuriant foliage. Mr. W. S. Egerton, Superintendent of Parks of Albany, states that a tree will endure defoliation by insects for about four years. Borers, such as the leopard moth, that destroy the branches, are more to be feared than the leaf-feeders. Evidences of the work of the leopard moth, however, were not sufficiently abundant to warrant the conclusion that the trouble was very largely due to this insect.

No doubt the trees of Flushing have suffered from insect attack, especially from that of the white-marked tussock moth, and I advised the Good Citizenship League to have the school children collect and burn the cocoons of this insect, also the larval cases of the bag-worm. As a result many thousands were thus destroyed last spring.

However, the impression seemed to be general among the people that the trouble was due not so much to the insects as to electricity from the trolley wires and to gas leaking from the mains. To investigate this matter a blank was prepared for the purpose of locating trees that had died within two years, and to determine whether the trees stood on the same side of the street as the gas mains or trolley wires, or across the street from the same. Twelve copies of this blank were sent to Mrs. Mary K. Whittaker, who distributed them among members of the Good Citizenship League. Twelve streets were recorded as having dead trees. All these streets had gas mains and five had trolley lines. Twenty-six trees were reported as killed. Eleven were on the same side as the gas main and five were across the street from it. The remaining ten were indefinitely reported. Two trees were mentioned as being on the same side as the trolley line and one across the street. Thirteen were on streets that had no trolley line. The trees reported as killed were Tulip, Linden, Southern Cypress, Elm, Maple, Oak and Fir. From the tabulation of answers the evidence seems strongest against the gas mains.

I visited the place again in August and had a dead tree dug up to see if gas had injured the roots. In this I was kindly assisted by Mr. Charles Thomas, Vice-President and General Manager of the Flushing Gas Company, who furnished the men to do the digging. A Maple tree, fifteen inches in diameter and about thirty-five feet high, which stood in front of the schoolhouse on Sanford avenue, was selected, a permit having been obtained from the Commissioner of Parks. The roots were much blackened, as if colored by acids, and a strong odor of gas came from the excavation. It should be stated, however, that the branches of the tree had been broken by the ice storm which occurred in February; telephone wires were strung upon it, and it had suffered somewhat from insects. Sections of the trunk and branches were sent to Albany by Mr. Frank A. Collins, Deputy Superintendent of School Buildings. These, though showing some rot, do not give evidence that the borers had injured the tree sufficiently to cause its death. It is well known, however, that leakage from gas mains is a common cause of the destruction of trees. Twenty were thus killed in Albany this year: six Norway Maples on Western avenue and fourteen Elms on State street. How much the death of trees in Flushing is due to leakage from gas mains can be determined only by the examination of a large number of dead trees, and this examination can be carried on best by the people who have suffered damages from this cause.

Trees are, no doubt, injured by electricity when feed wires come in immediate contact with the branches. Many instances are known of their having been set on fire from trolley wires. Unless such contact exists, however, it is doubtful if the trees receive any injury from electricity.

As in all cities, many trees had been damaged by mutilations, some by the gnawing of horses, and some by having been cut in digging for water mains, gas mains and sewers, and in laying curbstones. Trees also die, no doubt, from lack of plant-food, or from lack of water and air about the roots. Streets and sidewalks are made hard and nearly impervious to water and air, and trees standing close to them must suffer as a consequence.

I would refer the Good Citizenship League to Bulletin 131, published in November, 1900, by the Connecticut Agricultural Experiment Station, New Haven, Conn., and would advise that they act, as far as possible, upon the following recommendations, which I have here given essentially as they are written in that publication:

(1) The rigid enforcement of the city ordinances which forbid the bruising, injuring or destroying of trees, and the fastening of animals to trees in such a way as to injure the latter.

(2) That all trees, standing within reach of horses in the street, be protected by frames or wire netting so that they cannot be mutilated.

(3) That when limbs are removed from trees greater care should be exercised to cut them smoothly, close to and even with the trunk and without tearing the trunk bark. The exposed wood should be painted with coal tar.*

(4) That the stringing of electric wires be done only under the supervision of the Board of Public Works, and that this supervision be paid for by the company doing the work.

(5) That when trees are killed by gas leaking from the mains, the owners of the mains be required to pay to the city the cost of the removal of trees killed and of planting new trees in their places.

(6) That the land under trees in city parks be annually dressed with wood ashes.

(7) That on new streets, when the building line is far enough from the street line, it is desirable to plant just in front of the property line rather than just back of the curb.

(8) That trees infested with leaf-feeding insects be sprayed regularly for a few years, and thereafter as seems necessary.

(9) That in winter insects and the cocoons of insects that injure the trees be collected and destroyed.

I advised the Good Citizenship League concerning the measures that should be taken for the protection of the trees. As my recommendations, however, contained practically the same advice as those quoted from the bulletin referred to, it is unnecessary to repeat them here.

Trees at Port Jefferson.

On the twenty-first of November I visited Port Jefferson, Long Island, to determine, if possible, the cause of the unhealthy condition of Pine trees reported by Mr. A. W. Law, of New York City.

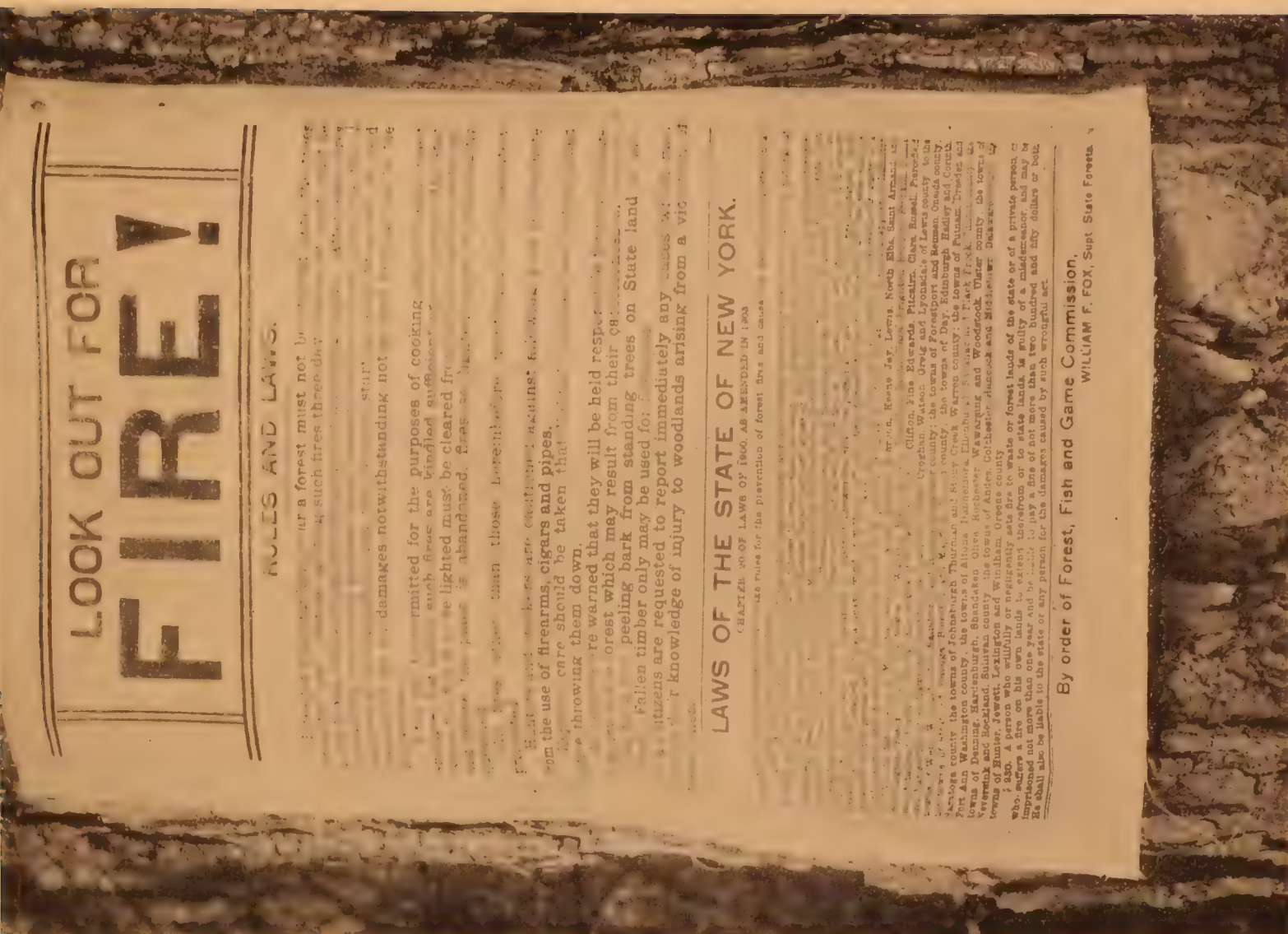
The trees I found to be Pitch Pine (*Pinus rigida*). They are in a park on the property of the Crystal Brook Park Association, of which Mr. Law is a member, and are situated on a gravelly ridge; excellent soil, I should judge, for the growth of this species. A number of trees were dead and others were fast dying.

Two trees were dug up by the roots and examined thoroughly. One of these was still alive though in a very weak condition, due, it appeared, to two causes. The tree had been pruned probably two or three years ago and decay had entered

* Professor L. H. Bailey, of Cornell University, recommends lead paint.



PIN OAKS KILLED BY LEAKAGE FROM GAS MAIN.
FLUSHING, L. I.
A. KNECHTEL, PHOTO.



LOOK OUT FOR FIRE!
A WARNING TO THE THOUGHTLESS.
FIVE THOUSAND OF THESE NOTICES, PRINTED ON CLOTH, ARE SENT EACH YEAR BY THE FOREST COMMISSION TO THE FIREWARDENS FOR POSTING OR REPLACING ONES THAT ARE DEFACED OR WORN OUT.
A. KNECHTEL, PHOTO.

the trunk through the wound. It was also suppressed by the shade of larger trees surrounding it. Several Pines in the park were found to be suffering from this latter cause. The other tree examined was dead. The roots, to the distance of four or five feet from the tree, had been attacked by fungi, which also had ascended the trunk for about two feet. The tree had also been much damaged by borers and bark beetles. I examined a large number of trees in the park and judged that disease among them was very largely due to insects and fungi.

The trees were being pruned at the time of my visit, the branches being chopped off at a distance of from three to six inches from the trunk, and fresh stable manure was being placed around the roots.

I would suggest that all old, rotting logs, all dead trees, and all dying trees beyond hope of recovery, be removed from the park, as this dead material furnishes excellent breeding-places for insects, and gives food for fungi, which also attack the living trees.

The trees should be trimmed with a saw and the branches should be cut close to the trunk. Spores of fungi, which will cause the tree to decay, find a good lodging place on a ragged cut, such as is made with a dull axe. If the branch is sawed off even with the trunk of the tree the new wood will grow over the wound, while no such healing will take place if it is cut leaving a stub. The wound should be covered with lead paint. This will exclude bacteria and fungi and check the weathering without injuring the cambium and bark. March is perhaps the best month for pruning, although the season is not so important as the manner in which the work is done.

I would suggest that wood ashes be used as a fertilizer. Stable manure contains beetles and fungi and brings them with it to the soil where it is applied, while these are destroyed by the ashes. Moreover, wood ashes contain all the elements that trees take from the soil, and hence are an ideal fertilizer.

A suppressed tree should be either relieved or removed. If, on account of its species, or for any other reason, it is a more desirable tree than the others that shade it, it should be relieved by the removal of one or more of the latter. Otherwise it should be cut, as it hinders the growth and symmetrical development of its neighbors.

Very respectfully,

ABRAHAM KNECHTEL,

Forester.

Special Report of Forester Pettis on the Gathering of Spruce Seed.

ALBANY, N. Y., *December 8, 1902.*

COL. WILLIAM F. FOX, *Superintendent State Forests, Albany:*

SIR.—In accordance with your directions I spent some time this fall in collecting a supply of seed from our native Red Spruce for use in the State nurseries next Spring, and would respectfully submit, in the following pages, a report on the details of the methods and operations connected with that work.

The collection of tree seed is as much the work of the forester as the gathering of seed-corn is that of the farmer. The market price of Red Spruce seed, when obtainable at all, is two dollars or more per pound, with no assurance of its quality or that it will germinate—facts which stimulated us in our efforts to secure a supply. The results obtained from this work may render a record of our experience valuable to others who may wish to collect seeds of this species, and may be useful at the office of the Commission in answering requests for information. Further work along this line will probably suggest better methods; but, such as they were, I will venture to describe them here. Only Red Spruce seed was collected, as no White Pine cones could be found in our forests this year.

Red Spruce Cones.

The cones of the Red Spruce (*Picea rubens* Sarg.) are ovate-oblong, narrowing gradually from near the middle to an acute apex. In length they vary usually from about one and one fourth to two and one fourth inches, with a diameter at the middle of five eighths to one inch. The cones are made up of scales attached to a central stem and overlapping one another, an average-sized cone having about fifty scales. At the base and on the upper side of each scale are two little depressions, each of which contains a winged seed. The seeds are small, about one third the size of a grain of buckwheat.

The largest quantity and best quality of cones were found on medium-sized trees, twelve to eighteen inches in diameter, situated above the swamps or on the hillsides. Similar trees were often found side by side—one with cones, the other without. There was no apparent reason for this difference unless it was that the fruiting tree enjoyed more light.



A. KNECHTEL, PHOTO.

TREE TOP OF FALLEN SPRUCE FILLED WITH CONES.



C. R. PETTIS, PHOTO.

RED SPRUCE CONES—THE DRYING ROOM.



The cones are found on the uppermost lateral branches, and usually at the tips, within six to ten feet of the crown. The greatest number are on the tip top, with the largest and best cones on the ends of the lateral branches or twigs.

Gathering the Cones.

After a trip through the Adirondack forests to find a favorable location for carrying on the work, a place was selected in the vicinity of Fulton Chain, where the trees were bearing well. There were six large lumber camps within a few miles, and the trees that were felled by the axemen gave us easy access to the cones, which were clinging thickly to the tops.

Progress at first was very slow. It was difficult to obtain laborers for this peculiar work. The men around the logging camps could not understand why any one wanted "Spruce buds," as they commonly call the cones. They hesitated, and were afraid to pick by the bushel. No amount of assurance that they could pick a certain number of bushels per day would get them started. Then again the "loose men" about a place are usually not very reliable, and one hesitates in hiring them by the day, especially if they are to be left to work by themselves. But the State requires only eight hours' labor for a day's wage, while the men in the lumber camps had to work ten hours or more, and so I succeeded finally in hiring enough help.

The cones were picked from the fallen tops on the lumber jobs; but as the location of each job was three or four miles from Fulton Chain, it became necessary for the men to board in the logging camps. These camps were crowded with their own men, but through the courtesy of Messrs. McMulkin, Wakely and Harwood I secured accommodations for the cone-pickers. It was a pleasure to note the interest taken by the lumbermen in this work, and I desire to acknowledge here the substantial assistance afforded by them whenever an opportunity occurred.

The prevailing high rate of wages—thirty-five dollars to forty dollars per month, with board—rendered the task of securing good men more difficult, especially as our job was a short one. But I finally obtained the few men I needed, industrious fellows, who did good work. The first man began September tenth at two dollars per day, and the second man on the twelfth. On the morning of the fifteenth four men went to work at seventy-five cents per bushel, and on the sixteenth a third man by the day.

Each man provided himself with a small axe, pail and a bottle of kerosene oil. He worked alone, following up a pair of sawyers, picking the cones from the

fallen tops, bagging and carrying them to where they could be loaded on a wagon or sled. The method employed varied with the individual. Some pickers put the pail on the ground, pulling off the cones with one or both hands, after the fashion of picking blackberries. Another method followed was to cut off the small, heavily laden twigs, and thrash them over the edge of the pail until the cones had all fallen into it. Probably the best way, especially for a man picking by the bushel, is one that might be termed the stripping method. The pail was set on the ground, under the end of a Spruce branch, or held between the legs. The picker reaches back along the branch, one hand on either side, shuts his hands and pulls towards him, stripping the cones off into the pail. A quart or more may often be obtained in this way at a single pull. The only disadvantage is that many small ends of twigs are broken off and have to be picked out later. As most of the cones are covered with large globules of soft pitch, the collecting is both unpleasant and slow. This difficulty, however, is easily remedied by a few drops of kerosene oil, which effectually cuts the pitch and allows the cones to fall from the hand into the bucket.

The cones were drawn to the drying-house at Fulton Chain every third day, or oftener. They could not be left in the sacks any longer, as they are at all times apt to become heated. A reddish-brown color, a feeling of warmth, or a strong, sprucey odor, are indications of heating. The topography will naturally affect the expense of cutting roads and difficulty in getting the cones to the drying-house. In this case the cartage amounted to ten cents per bushel, the distance averaging six miles for the round trip.

Drying the Cones.

A room for drying the cones, so that the scales would open and loosen the seeds, was rented at Fulton Chain Station. Wooden frames or racks, like the bunks in a logging camp, were erected, into which the sacks were emptied and the cones spread out to dry. Two stoves were put up in the room, and the drying process was thus hastened by artificial heat.

Where a considerable quantity of seed is to be gathered, the bulky volume of the cones necessitates a large room with a great area of drying space. From our experience in this particular part of the work it would appear that the best form for the racks or bins can be obtained by using two by four scantling for uprights, with cross-pieces for the support of the boards which form the bottoms of the bins. As the cones are heavy, these uprights should be placed at intervals of six feet. The bins should be in tiers, one above another, four tiers high. The

bottom one may rest on the floor; the next one should be twenty inches above the floor, while the two upper ones may be eighteen inches apart, the distance being dependent on the ease with which the cones can be stirred and handled. The tiers should run the whole length of the room, with aisles of suitable width, say two feet and a half wide. The bins should be five feet wide; if wider, it will be inconvenient to reach the middle, and if narrower, there will be too great a proportion of aisle space. For the sides of the bins, inch boards, four or five inches wide, turned on edge, may be used, although the mass of cones should not be over three inches deep. The sides and bottoms should be made of inch boards dressed on one side and jointed on the edges; then any shrinkage of the bottom boards, caused by seasoning, can be taken up by inserting wedges between the upright and the edge of the outer board. No nails are necessary, and the boards can be taken down whenever the space is needed for other work. A tight bottom can also be obtained by using tongued and grooved flooring ("matched stuff"), but the framework cannot be taken down so readily.

The cones, when brought to the drying-room, were emptied from the sacks in a pile on the floor, where they were shoveled into a half-bushel measure, carried to the racks or bins and spread out to dry, a record being kept of the number of bushels thus handled. For clean cones the measure was taken level full, but when they were not clean the measure was heaped to make allowance for dirt and bits of twigs. When the cones were very dirty, the leaves, dirt, bark, dead cones and twigs were picked out before measuring.

Cost of Gathering Cones.

Eleven and one half bushels were received September thirteenth; fifty-four bushels on the eighteenth; seventy-two and one half bushels on the twentieth; thirty-three bushels on the twenty-second; twenty-nine and one half bushels on the twenty-third; total, two hundred and one half bushels. Of this amount one hundred and forty-two bushels were received from the men who picked by the bushel and fifty-eight and one half bushels from the men who worked by the day.

The cost of the cones obtained from men working by the day was eighty-seven cents per bushel, or twelve cents more than those picked by the job. Good men can easily average six to eight bushels per day when the yield of cones is as large as it was this season. One man, by stripping the cones from the branches, picked twenty-eight bushels in three days. The difficulty is in getting men started, and it was for this reason that the liberal rate of seventy-five cents was offered. In a good seed year fifty cents per bushel would be a sufficient inducement,

as profitable wages can be earned at a less rate by men who are not afraid to work. The total cost for picking the two hundred and one half bushels was one hundred and fifty-seven dollars and twenty-five cents, an average of seventy-eight cents per bushel.

Extracting the Seeds.

Drying the cones and extracting the seeds is by far the most important and critical part of the entire work. It is the longest process, one requiring the most careful attention and the exercise of good judgment. When cones dry naturally the scales near the base do not open and liberate the seeds, but in a room properly warmed these scales open freely so that the seeds will drop out. The length of time necessary for Spruce cones to dry, so that they will open satisfactorily, depends:

- (1) On the number of square feet of drying space per bushel.
- (2) Whether the cones dry naturally, or whether artificial heat is used.
- (3) The time of year when the cones are picked.
- (4) The humidity of the air during the drying process.
- (5) The care exercised in stirring, sorting and cleaning while in the racks.

Naturally the thinner the cones are spread on the floor of the bin the faster they will dry. A liberal allowance of space would be twelve square feet per bushel. In a drying-room, which is well heated and thoroughly ventilated, they will open much quicker than if the process is conducted under other conditions. Ventilation is necessary to carry off the moisture and thus prevent mildew, for if no heat is used the cones will lie in the racks a month or more without opening.

Spruce cones picked when green are especially slow in opening. Those gathered before September twentieth were, in this case, the last to open, while those picked last opened first. Those received on September thirteenth lay in the racks three weeks without showing any signs of drying, but the stock received last began to open in less than a week.

When a few pounds of seed only are needed, September twenty-fifth, or thereabouts, would be the best time for gathering Spruce cones in the Adirondacks. After October first the shock to the tree in falling is sufficient to shake a large part of the cones from the branches. It does not pay to pick them off the ground, for they are too much scattered and covered with the rubbish that clings to their pitchy surface.

When the cones are first brought in from the woods they are so thickly smeared with sticky, resinous matter that, when spread out on the racks, they



A. KNECHTEL, PHOTO.

LUMBER JOB WHERE THE CONES WERE PICKED.



C. R. PETTIS, PHOTO.

PLANTING AN OLD BEAVER MEADOW NEAR LAKE CLEAR JUNCTION.

A STACK OF WILD HAY APPEARS AT THE RIGHT, NEAR THE BROOK.

are liable to form a solid mass and harden. Unless they are stirred daily to keep this cake thoroughly broken up the drying process will be seriously delayed. After a week or ten days, however, this troublesome condition ceases.

During the drying process heat may be used all the time, or only at the finish. A large box-stove in the room, combined with ample means for ventilation, will greatly facilitate the work. Should the weather be damp and cloudy, and no heat be used, the cones will lie on the racks for weeks without showing any signs of opening; but if the air in the room be warmed and dried, in a few days you will both see and hear the scales open.

When the drying and opening process is fairly under way the partly opened cones are assorted and placed in some warmer spot, after which the basal scales will also yield and liberate their seeds. While the cones are drying considerable moisture is thrown off, necessitating a complete ventilation of the room and a daily stirring of the cones to prevent mildew. Should mildew appear the cones must all be picked over and any thus affected thrown away. The racks must be stirred twice each day and better ventilation provided.

The Spruce cone is frequently infested with a borer which burrows in it and destroys it without eating the seed. It usually bores into the smaller end, making a hole scarcely larger than a pinhead. On this job the cones were all picked over carefully by two men, who removed and burned the ones thus infested, after which I had no further trouble from these worms.

The cones, as fast as they opened fully, were picked out of the bins and thrashed at the rate of ten bushels per day. A bushel of green cones doubles its bulk in the opening process. The removal of the opened cones depleted the contents of the racks so that the remaining ones dried much faster—so rapidly that we were soon able to take them off the upper bins by the double handful and to reduce the temperature in the room. Towards the close of the work three men could assort and thrash forty bushels of open cones per day.

Thrashing Out Seed.

When the cones were fully opened, ready for thrashing, they were sacked and left until ten bushels had accumulated. Then a peck of the opened cones were put into a two-bushel bag, swung in the air and pounded on the floor, first swinging the bag over one shoulder and then over the other so that the bag would strike alternately on opposite sides. About twenty-five hard strokes removes the seeds from the cones. The contents of the bag were then poured out on a wire screen with a quarter-inch mesh (a "sand screen") through which the little

black seeds were sifted into a receiving-box, the cones and refuse remaining on top being thrown into a heap to be used for fuel.

One man can thrash ten bushels per hour, but the work should be arranged so that the thrashing should not last over an hour or so at a time. It should be done in a separate room or out of doors, because in pounding the cones the dried pitch is pulverized and fills the air so that breathing becomes difficult. To alleviate this annoyance each man wore a wet sponge over his mouth and nose while thrashing.

Cleaning the Seeds.

The small size of Spruce seed renders the cleaning process difficult. The seeds and dirt that fell through the screen into the box were sacked and stored in the drying-house, where they would not gather dampness, to await the final process of cleaning. When the time came to take up this part of the work the seeds and fine dirt were taken from the sacks and rubbed through a screen with a fine mesh to remove the larger particles of dirt, after which the seeds were put through a fanning-mill. The wings of the seeds were broken and removed, for the most part, in the thrashing, but some pieces, together with other material, still clung to the seeds, and a fanning-mill was necessary to thoroughly clean them of all chaff and dirt. On this job no mill was easily obtainable, and so I constructed one to suit the emergency. It had four fans on its shaft, and was provided with a double row of sieves. A four-inch pulley was attached to the shaft and belted to a grindstone for the power. It was a crude, home-made arrangement, but it did the work all right.

When the mill was in motion the seeds were emptied into it, just back of the fan and in front of the first sieve. The heaviest ones fell directly down, through the mill, in front of the sieve and into a bag, while the dust and lighter seeds were carried back where they received a further winnowing. The heavier seeds that fell in front, freed from chaff and impurities, were kept separate. The lighter seeds that fell through the farther opening were put through the mill again, and these were also kept separate. Any seeds that were blown beyond the front screens a second time were thrown away, as they evidently were not well filled.

As a final result we obtained 375 pounds of seed, or nine and three eighths bushels, from the 200 bushels of cones. Of this amount 205 pounds were seeds of the first quality. The following summary of facts, obtained during the course of the work, may be valuable for future reference:

Six to eight bushels of cones can be picked, on the average, by one man in a day's work of eight hours.

Fifty cents per bushel will enable a man to earn a fair day's wages.

Ten to fifteen square feet of drying space is required for a bushel of cones.

Sixty pounds per bushel is the weight of green cones.

One bushel of green cones will make two bushels of opened cones

One bushel of green cones will yield, on an average, $1\frac{7}{8}$ pounds of seeds.

One bushel of green cones will yield, on an average, $1\frac{1}{2}$ quarts of seeds.

One quart of seeds will weigh $1\frac{1}{4}$ pounds.

One bushel of seeds will weigh 40 pounds.

One ounce of seeds contains 7,500 grains.

One pound of seeds contains 120,000 grains.

One quart of seeds contains 150,000 grains.

Three hundred and seventy-five pounds of seeds contain 45,000,000 grains.

Three hundred and seventy-five pounds of seeds cost for collection \$355.72.

One pound of seeds costs for collection 95 cents.

One quart of seeds costs for collection \$1.19.

One pound of seeds costs at dealer's price \$2.

One dollar and five cents per pound saved in collecting our own seed.

Three hundred and ninety-three dollars and seventy five cents saved on 375 pounds of seeds.

The seeds are stored for the winter in a building near Lake Clear Junction, Franklin County, ready for our spring work. They are in paper sacks, fifteen pounds to the sack, packed in sand, well protected from mice, moisture, drying out and other injurious conditions. The stock on hand is larger than is needed for our nursery work, but the surplus can be used to good advantage for broadcast sowing on denuded areas, or for underplanting in forests where it may seem desirable to create an undergrowth of Red Spruce. As we have such a large supply on hand, some of the seed might be distributed free to any of our citizens who may want to reforest their lands with trees grown direct from seed.

All of which is respectfully submitted.

CLIFFORD R. PETTIS,
Forester.

The Fauna of the Woods.

FACTS AND STATISTICS ABOUT THE ELK, DEER AND MOOSE OF THE ADIRONDACK REGION.

In response to a continued and growing demand for information about the larger animals of the Adirondack region, the Commission has followed its usual course in collecting various facts and statistics relating to the fauna of the woods. Great care has been exercised to have the facts and figures given represent accurately the conditions as they exist, and it is believed that the camper, the sportsman, and even the resident of the Adirondack counties, will find something of interest and value in what follows. The proof that the herds of Deer are steadily increasing will, of itself, give much satisfaction, and the success that has attended the effort to restore Moose to the woods will undoubtedly prove gratifying to the many citizens interested in the movement. The introduction of Elk is at best an experiment, but it has thus far proved to be successful, and the people of the State are indebted to a public-spirited citizen for generous donations of these valuable animals. Many letters received by the Commission attest the pleasure which the vast army of visitors to the Adirondack region has experienced, and is yet to experience, from the introduction in this territory of the animals mentioned.

The Adirondack Deer.

One of the very best evidences of the value of protection is furnished by the marked increase in the number of Deer secured by hunters in the Adirondack region annually. In spite of all predictions to the contrary, the herds of Deer have steadily grown; and although the army of hunters is continually increasing, as shown by the heavy travel to the woods during the hunting season, the inroads made yearly have not appreciably diminished the number of these animals within the State's forest domain. In response to the continued demand of those interested in this subject, the Commission has collected, with the aid of the American and the National Express Companies, a record of the shipments made during the hunting season of 1902. These figures, and those of the two preceding years, are as follows:

Year.	Carcasses.	Saddles.	Heads.
1900	1,020	89	95
1901	1,062	103	121
1902	1,354	113	193

From the increase in the number of carcasses shipped it will be seen that, in round numbers, about thirty per cent more Deer were secured by hunters in the Adirondacks during the season of 1902 than during the previous year. By following the generally accepted rule, that four Deer are killed in the woods for every one shipped out by rail,* the great increase in the returns secured by sportsmen as a result of protecting these animals will be readily seen.

The interesting statistics furnished by Superintendent John L. Van Valkenburgh, of the American Express Company, and Superintendent T. L. Smith, of the National Express Company, who vouch for the accuracy of the figures given, are as follows:

SHIPMENTS OF DEER FROM POINTS IN THE ADIRONDACK REGION.
SEASON OF 1902.
MOHAWK AND MALONE RAILROAD.

RAILROAD STATION.	Carcasses.	Saddles.	Heads.
Beaver River	117	2	18
Big Moose	45	2	7
Brandreths	4	.	3
Childwold	16	4	.
Clear Water	20	1	.
Eagle Bay	14	.	.
Floodwood	13	.	.
Forestport	24	5	1
Fulton Chain	58	9	.
Hinckley	1	.	.
Horseshoe	2	.	.
Lake Clear Junction	7	.	.
Lake Placid	1	.	4
Little Rapids	3	.	.
Long Lake West	44	3	.
Loon Lake	8	1	.
McKeever	17	1	.
Minnehaha	9	.	2
Ne-ha-sa-ne	2	.	19
Nelson Lake	3	.	.
Onchiota	5	.	.
Otter Lake	10	.	.
Paul Smith's	11	.	7
Piercefield	31	3	7

* A large number of deer are taken out of the woods each season in wagons by farmers and sportsmen who live near the borders of the Great Forest of Northern New York; and a large amount of venison is consumed in the hunting camps, lumber jobs, hotels and by the "natives" or residents of the woods.

MOHAWK AND MALONE RAILROAD—(Concluded).

RAILROAD STATION.	Carcasses.	Saddles.	Heads.
Pleasant Lake	9		
Poland	17		
Rainbow Lake		2	
Raquette Lake	21	5	
Saranac Lake	6	2	
Saranac Inn	3		
Tupper Lake Junction	64	6	6
White Lake Corners	9		
Woods Lake	24		
Total	618	46	74

NEW YORK AND OTTAWA RAILROAD.

Brandon		1	
Derrick	29		3
Dickinson Center	2		
Kildare	8		1
Madawaska	6		1
Santa Clara	14		2
Spring Cove	18		
Sherman	3		
St. Regis Falls			4
Tupper Lake	2		8
Total	82	1	19

UTICA AND BLACK RIVER RAILROAD.

Alder Creek	8		
Benson Mines	42	2	
Boonville	4		
Carthage	2		4
Castorland	5		
Glenfield	27	1	2
Harrisville	30	5	
Jayville	3		
Lowville	5	2	
Lyon Falls	13		
Natural Bridge	5		
Newton Falls	74	3	3
Oswegatchie	18	4	1
Port Leyden	1		
Prospect	40	1	
Total	277	18	10

ROME, WATERTOWN AND OGDENSBURG RAILROAD.

RAILROAD STATION.	Carcasses.	Saddles.	Heads.
Antwerp	2		
Canton	8		2
De Kalb Junction			2
Edwards	3	1	
Emeryville			1
Limerick	1		
Potsdam	36	1	
Total	50	2	5

FONDA, JOHNSTOWN AND GLOVERSVILLE RAILROAD.

Broadalbin	2		
Gloversville	7		
Johnstown	8		
Northville	96	13	20
Total	113	13	20

LITTLE FALLS AND DOLGEVILLE RAILROAD.

Dolgeville	9		
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NEW YORK CENTRAL AND HUDSON RIVER RAILROAD.

Fonda	4	2	
Little Falls	1		
Total	5	2	

RUTLAND RAILROAD.

Malone	3		21
Winthrop	4		1
Total	7		22

DELAWARE AND HUDSON RAILROAD.

Corinth			2
Warrensburgh			2
Saranac Lake	1		
Ticonderoga	1		3
Port Henry	24	3	6
Loon Lake	1		4
Stony Creek	23		
Bloomington	1		
North Creek	104	28	2

DELAWARE AND HUDSON RAILROAD — (*Concluded*).

RAILROAD STATION.	Carcasses.	Saddles.	Heads.
Riverside	27		5
Hadley			1
Caldwell	2		
The Glen	4		
Westport	4		17
Crown Point	1		1
Total	193	31	43

RECAPITULATION.

Mohawk and Malone Railroad	618	46	74
New York and Ottawa Railroad	82	1	19
Utica and Black River Railroad	277	18	10
Rome, Watertown and Ogdensburg Railroad	50	2	5
Fonda, Johnstown and Gloversville Railroad	113	13	20
Little Falls and Dolgeville Railroad	9		
New York Central and Hudson River Railroad	5	2	
Rutland Railroad	7		22
Delaware and Hudson Railroad	193	31	43
Total shipments	1,354	113	193

From the weight of the carcasses recorded in the shipping bills of the express companies it will readily be seen that the Adirondack Deer, when properly protected, will develop a size and weight fully equal to or surpassing that of the species in any other locality in North America. The following are some of the shipments reported which seem worth noting:

SHIPMENTS OF ADIRONDACK DEER.

RAILROAD STATION.	Consigned to—	Dressed weight.*	Live weight.
Big Moose	C. P. Floyd, Remsen	203	254
Eagle Bay	J. Larsehn, New York City	200	250
Hinkley	J. L. Roberts, New York City	225	281
Lake Clear Junction	J. Mulholland, Saranac Lake	206	257
Benson Mines	C. Simmons, Ogdensburg	200	250
Benson Mines	H. Miller Jr., Harrisville	202	252
Boonville	W. A. Brown, Utica	225	281
Carthage	D. Mosher, Watertown	200	250
Castorland	Harry Waugh, Fulton	209	261

SHIPMENTS OF ADIRONDACK DEER —(*Concluded*).

RAILROAD STATION.	Consigned to—	Dressed weight.*	Live weight.
Glenfield	George Bacon, Herkimer	208	260
Lowville	L. Freis, New York City	200	250
Lowville	A. G. Lewis, Buffalo	205	256
Lyon Falls	H. L. Smalinger, Utica	200	250
Newton Falls	D. Gayne, Watertown	208	260
Prospect	George Windheim, Utica	211	264
Johnstown	J. Stewart, Albany	200	250
Northville	J. Reefer, New York City	235	294
Northville	C. C. Weimer, Albany	202	252
Northville	H. M. Bowler, Amsterdam	210	262
Northville	R. Christian, Amsterdam	210	262
Northville	J. Osborne, Johnstown	215	269
Dolgeville	Ralph Graham, New York City	204	255
Winthrop	F. F. Stevens, Ogdensburg	200	250
Otter Lake	W. E. Champayn, Corning	226	282
Tupper Lake	A. W. Lasher, Canajoharie	250	313
Port Henry	J. E. McGue, Rouse's Point	204	255
Stony Creek	G. A. Lawton, Hadley	220	275
North Creek	Mrs. Charles Smith, Glens Falls	219	273
Riverside	F. Pallarand, Saratoga	240	300

* As weighed and billed by the agent of the express company.

By adding one fourth to the dressed weight, the live weight of the animal may be determined with reasonable accuracy.

Moose and Elk.

Under the appropriation of \$5,000 made for the purpose of restoring Moose to the Adirondacks, the Commission will, by the time this report reaches the public, have procured and liberated in the forest a dozen of these animals. It is expected that as many more will be secured in the near future. The restrictions on the shipment of Moose from other States and from Canada have made it extremely difficult to procure these animals, and carload lots are practically an impossibility. Stringent laws exist in Canada and elsewhere against the shipment of live Moose at any season. Those which have been secured and placed in the Adirondacks have done well, and Protector J. Edward Ball, who has had charge of the work of liberating the animals, reports that they are now in excellent condition. The Moose were set at liberty near Uncas Station and have yarded for the winter in two places—one

just south of Raquette Lake and the other about three miles east of Big Moose Lake. The report of the protector says: "The Moose are doing well, and there seems to be no reason why they should not increase in the Adirondacks. They have plenty of food, and will do well if let alone." He says further: "The residents of the Adirondacks are taking great interest in the work of restocking the woods with Moose, and, with the railroad employees, render all possible assistance in handling the animals." One of the Moose liberated last summer was shot by unknown campers in the vicinity of Eighth Lake, and the Department is now investigating the matter. Under the appropriation furnished the work already done toward procuring Moose has greatly encouraged all those interested in the effort to secure the return of this magnificent animal to the Adirondack region.

In addition to the twenty-two Elk placed in the Adirondack forest a year ago, which were the gift of Hon. William C. Whitney, forty others have been shipped by him from his private preserve at Lenox, Mass. This generous gift will be thoroughly appreciated by all lovers of the Adirondack forests, and entitles Mr. Whitney to the thanks of the people of the State. The Elk were donated from Mr. Whitney's October Mountain estate, and were shipped to Long Lake West. Five other Elk were given during the year to Mr. William Dart, of Dart's Camp, near Big Moose Lake, by the Binghamton Park Commission. They will be cared for during the winter by the Brown's Tract Guide Association and liberated in the spring. Mr. Harry V. Radford, who is an enthusiastic supporter of the plan to restock the Adirondacks with Elk and Moose, recently paid a visit to the woods for the purpose of estimating the number of Elk now there. His figures show that there are upwards of eighty, which include those liberated and those born in the forest. Both the Elk and the Moose are greatly admired by visitors to the Adirondacks, of which there are thousands every summer, and it is believed that these animals will thrive and become an important feature of the northern wilderness.

The Black Bear.

The same forces which united to secure the restocking of the woods with Elk and Moose are now interested in an effort to protect the Adirondack Black Bear. Reports from all sections of the forest indicate that this is a move in the right direction, and that, with suitable protection, the Bear will soon multiply to such an extent as to become again an important factor in the game of the region. No estimate has been made of the number of these animals in the Adirondacks, but there is no doubt that unless proper protection is given, the Black Bear is in danger of becoming extinct in Northern New York.

Report of the General Foreman of Hatcheries

1902

To the Forest, Fish and Game Commission:

GENTLEMEN.—I herewith present my report for the year ending September 30, 1902, showing the number of fish distributed by the Commission, the number of each kind of fish and the size, from which hatchery or hatching station distributed, and where the fish were planted.

There were 1,459 applications received by the Commission during the year and 240 carried over from the previous year, making a total of 1,699 to be filled during the year. Of these 1,078 were filled, 94 rejected for various reasons, leaving 527 on hand at the close of the year.

No applications for Black Bass have been filled during the year, but several thousand have been taken out of the canal and waterworks reservoirs at Rochester and planted in near-by waters.

The policy adopted by the Commission, of rearing fingerling and yearling fish for distribution, has been followed throughout the year, and every effort has been made to increase the output of these sizes. The results of planting fingerlings have been particularly satisfactory and productive of good results.

Improvements Made.

An additional pipe has been put in at the Adirondack Hatchery which will more than double the capacity of that hatchery for rearing fingerlings. The output from that hatchery has been much larger than ever before.

I would suggest that the plan adopted for improvements at that hatchery be also adopted at the Fulton Chain Hatchery. This would give an opportunity for a larger distribution in a section of the Adirondacks where the fish are much needed.

The increased number of applications for fingerling fish will make it necessary for the Commission to continue increasing the facilities for rearing fingerlings at each of the hatcheries. Very few applications are made now for Trout fry.

Spring Creek at the Caledonia Hatchery has been thoroughly dredged and cleaned during the past year, and I have every reason to believe that the results will be much more satisfactory during the coming year.

During the past year a new hatchery building, sixty by twenty-two feet, on Whortleberry Creek in Cold Spring Valley (Margaretville, Delaware County), has been built. The stream is a never failing one of pure spring water, with a very even temperature throughout the year. About 120,000 Trout have been reared during the past summer, a part of which has been distributed, and the balance of about 50,000 was carried over for yearlings. This hatchery is located in a part of the Catskills where there are numerous Trout streams and water suitable for Trout, making it an admirable location for distribution. The result of the work of this hatchery will be very evident in a year or two, and cannot help but add to the attractiveness of the Catskill region. An expenditure of \$3,000 or \$4,000 for the purpose of constructing rearing ponds, races, dams and ponds would add very much to the efficiency of the hatchery, and the output could be increased about four times.

Rearing Black Bass.

The season at the Oneida Hatchery has been most satisfactory. I would suggest that \$2,000 be expended at this hatchery for the purpose of constructing suitable ponds and races for rearing Black Bass, which are much sought after from all sections of the State. I know of no better place for the purpose, as the waters are suitable for Black Bass and the grounds are adapted to the construction of the necessary ponds and races.

The Beaverkill Hatchery has been closed, as the location was not suitable for a hatchery, the water being insufficient. All of the implements, cans, etc., have been transferred to the Delaware County Hatchery. The building is of good construction and in good condition, and I would suggest that the Commission make some disposition of it as soon as possible.

The output of the Cold Spring Hatchery has comprised the usual number. The quality of the fish sent out has been of the best. A new heater should be put into the hatchery and some repairs should be made to the foundation of the building.

The usual number of fish have been reared and sent out from Pleasant Valley Hatchery. The results of the work of this hatchery are apparent in Keuka Lake, where fishing, during the last two or three summers, has been better than in any other waters of the State.

The Maskalonge Supply.

The work at the Chautauqua Lake Hatchery has not been as satisfactory as I could wish. The spearing of Maskalonge through the ice in the winter will sooner or later completely deplete the lake of this species. I have been informed by reliable persons that thirty tons of these fish were killed with spears last winter. Of course, there can be but one end if such a slaughter continues. You will note from a previous report that the number of fry taken from Chautauqua Lake each year decreases very materially. It is to be regretted that the law permitting spearing cannot be repealed.

The Sacandaga Hatchery is not well located and the water supply is not what is necessary to show good results under the policy adopted by the Commission, *i. e.*, rearing fingerlings. A small expenditure of money for the construction of rearing ponds on some suitable spring brook, a few miles from a railroad station, would show much better results with the same cost of maintenance.

The United States Commission has granted every request we have made, and thanks are returned for assistance rendered.

Every effort has been made to increase the output of cheap food-fish, and the figures will show the result in the numbers planted. The result of stocking the larger bodies of water of the State and Lake Ontario must show satisfactorily in the very near future.

The usual exhibit was made at the State Fair. These exhibits are inexpensive and always prove very instructive and attractive. I would suggest that they be continued.

The increase of Carp in some of the best fishing waters of the State still continues, and there appears to be no way of stopping it. They are a very difficult fish to exterminate.

Few, if any, complaints have been made of the messengers who delivered fish to the applicants, and very few fish have been lost in transportation. The few losses in every instance proved to be due to the fault of the applicant, who failed to meet the fish promptly at the time specified.

The policy of the Commission of beautifying the grounds about the hatcheries and making them attractive has been adhered to strictly. The expense is slight, as nearly all the labor is performed by the regular employees of the hatcheries. The grounds at the Caledonia Hatchery might well be called a park, as they are extensive and well arranged. The flower beds are large and very attractive, and it is a popular resort for a large number of people during the summer months.

The grounds at the Cold Spring, Adirondack and Pleasant Valley Hatcheries are small, but are made attractive with well-kept lawns, numerous flower-beds and shrubbery.

Mongolian Pheasants.

The rearing of Mongolian Pheasants is still carried on at the Pleasant Valley Hatchery at a very slight expense to the State, and the birds are distributed to applicants as usual. Reports from various localities indicate that the Pheasants are thriving, and that they are highly valued by those who receive them and who, in every case, pay careful attention to their increase.

In conclusion, your attention is called to the very liberal courtesies extended to the Commission by the railroads of the State (particularly the New York Central and Hudson River Railroad, the Ontario and Western, the Delaware and Hudson Company, and the Buffalo, Rochester and Pittsburgh Railroad) for transportation furnished free to the State fish car and to the messengers in charge of the fish, and in returning the empty fish cans.

Respectfully submitted.

RICHARD COTCHEFER,

General Foreman of Hatcheries.



Report of the Chief Game Protector

1902

To the Forest, Fish and Game Commission:

GENTLEMEN.—I have the honor to submit the following report, showing the work of the force of protectors under my supervision, and calling attention to some of the changes which occur annually in the form of amendments to the law, and to other points that may be of interest to your Honorable Board, as well as to the many persons who take a deep interest in the protection of the forests and game of the State and the propagation and distribution of fish, which has been carried on so systematically and extensively that nearly all of our once depleted waters have become profitable for commercial fishing and furnish sport for myriads of anglers.

Having been in the service for more than fourteen years, I feel like intruding a little by calling attention to some very important changes that have occurred in the work, so that recent converts to protection may know something of the darker days and the difficulties under which the small handful of protectors and the few sympathizers and supporters of the law labored at that time as compared with the present state of affairs.

The Force of Protectors.

Prior to 1892 there were but fifteen protectors for the entire State, with apparently no prospect of an increase, as the market hunter, together with the net fisherman, presented such a solid front that it seemed impossible to make any headway against their opposition to better laws. But, many thanks to the few never tiring associations and persons who could see that, with the forests denuded and the fish and game exterminated, the health and pleasure seeker would soon abandon this State for other fields, thereby entailing expense which many could not afford and which would have left the now prosperous health and sporting resorts surrounded by barren ledges and unprofitable farming land as against untold wealth at the present time. The first notable change for the better was brought about by an act of the Legislature in 1892, as that body began to

see the force of the argument presented by lovers of fair play, increasing the number of game protectors to twenty. This broke the ice, although many protests were made on account of an increase in taxes. In 1895 a more liberal act was passed, increasing the number to thirty-eight, which was further increased by twelve by the Legislature of 1902, making at the present time a force of fifty game protectors. I must say for the benefit of persons interested, and as a compliment to the Forest, Fish and Game Commission, who have taken the utmost care in selecting the additional twelve men, that the State now has fifty game protectors who, with scarcely an exception, are bright, intelligent men, well located to carry on the work assigned them. One can see this is not a large force when taking into consideration the vast tracts of land which the State has in the Adirondacks and Catskills which require constant watchfulness, as against trespassers, the protection of game over the entire State, the numerous rivers and lakes where incessant warfare is necessary against a persistent horde of net fishermen and dynamiters, together with the large interests the State and individuals have in oysters, clams and lobsters in the waters over which the State has jurisdiction. The entire expense for the protectors is much less than many of the second-class cities of the State are paying for their police forces. It is a wonder to many how such efficient men can be secured when informed that the average protector only received \$500 per year, with an allowance of thirty-seven dollars and fifty cents per month for expenses.

Illegal Devices Seized.

The table in the appendix will show the work of the protectors during the past year as to the number of nets and other devices which, while being illegally operated for the taking of fish, were seized and destroyed; also the number of actions brought and concluded.

Several cases which are commenced near the close of the year necessarily go over from year to year, fail to be reached for trial, or are appealed to higher courts.

Actions Against Squatters.

Many actions for ejectment have been commenced against "squatters" on State land who persist in building and otherwise trespassing. One important case, known as *Wells vs. Johnston & Gibby*, was decided by the Court of Appeals in favor of the people, which settled any further question as to the State's title



PIKE FISHING.

to a tract of land known as the North Gouverneur Tract, in Oneida County. The action arose on account of the seizure and sale by the Commission of about \$700 worth of pulp-wood cut on said lot and sold to Johnston & Gibby, whom the Commission were bound to protect in the purchase. Mr. Wells claimed title to the land by a county tax sale of Oneida County, and this decision settles for all time any claim against land acquired by State tax sales over county sales.

The Cold Storage Case.

The noted case of the People *vs.* The Arctic Refrigerating Company of New York City, which was being pressed in the Appellate Court at the time of the issuance of the last report of the Commission, is now in the Court of Appeals waiting its turn with other cases, and, judging by the decisions of the Supreme and Appellate Courts, the people will be successful as to the major portion of their claims. The defective points in the law, which affected a portion of the amount claimed by the people, was so amended by the last Legislature that it now conforms to what the courts held it should have been, and the masses of people interested in the protection of song and insectivorous birds now realize that they have a law to stand on no matter what may have been said to the contrary.

Game Law Amendments.

Several amendments were made by the last Legislature which materially improve the Game Law and make possible the maintaining of actions as against the former law. One very important amendment, which refers to fish and game coming from without the State, now puts the Department in a position to bring and maintain actions for possession no matter where said fish and game come from. This was not possible under the old law after the decision of the Court of Appeals in the case of the People *vs.* The Buffalo Fish Company, as the Court held in that case that it was not the intent of the Legislature, when passing the law relative to possession, that it apply to fish coming from without the State.

While continuous amendments from year to year are not advisable, as a constant tampering with the law is confusing and misleading to the many people interested, I feel that a few slight changes are necessary: First, for a more uniform law as to open and close season in all counties, and make it possible for one to hunt and fish in safety without stopping to determine the county lines. Many of these laws are useless, and the benefit derived is of little or no value.

Suggested Legislation.

The law affecting Black Bass should be uniform, and not as at the present time, one law for the waters of the Thousand Islands, where the season opens six days before it does through the State generally—especially as it makes two dates in one county, viz: St. Lawrence County.

It is evident that Grouse are becoming scarcer yearly, and especially this year, as last spring was so very wet and cold that it is generally believed many broods were drowned; therefore it is recommended that the sale of Grouse killed in this State be prohibited.

I would also suggest prohibiting the sale of venison killed within the Adirondack Park. This would do away with quite a few market hunters who manage to get around the law relative to transportation and make a business of hunting wholly for the market. While the anti-hounding law is working admirably and the Deer are steadily on the increase, the law cannot be made too strict or severe as to taking or harboring dogs of any description in forests which Deer inhabit, as it is an undisputed fact that nearly all species of dogs will follow a Deer and aid in its capture. In view of what the State has expended in past years in purchasing Deer to restock the Catskill region, the law ought to be amended so as to continue a close season in all the Catskill counties for at least three years.

I would also recommend that no Deer be taken for at least three years in Oswego County, and in all that portion of Oneida, Lewis and Jefferson Counties lying west of the Black River Railroad from Utica to Carthage and south of Carthage, and the Rome, Watertown and Ogdensburg Railroad from Carthage to Richfield Junction. In this locality there is a large tract of timbered land well adapted for Deer where they were exterminated many years since, but in the last few years several Deer have found their way into that locality and should be protected.

The law regarding the use of nets in Raritan Bay is such that it affords no protection to the inhabitants of Staten Island and Greater New York, who are interested in angling, as against non-resident Menhaden fishermen—mostly from New Jersey. The law should be amended to either prohibit the use of nets in said bay, or a law passed compelling purse-net fishermen to procure licenses, which would give a protector some authority to board vessels to determine what fish are being taken. The law regarding a non-resident paying a license to fish or hunt in this State is not at all plain, neither does it fix an amount as a fee. Therefore, as many States charge a license fee to non-residents, we would

recommend the law being amended so as to be more explicit, and also to specify the amount of the fee.

As in my last year's report, I would recommend that if game or fish are found in the close season outside of warehouses where they can be bonded under the present law, a law should be enacted declaring that if a seizure is made, after the articles have served their purpose as evidence, they should be turned over to the nearest charitable institution instead of being allowed to waste, thereby giving the officer making the seizure, or the Court before which it had been used as evidence, something definite under which to act.

I must continue, as in the past, to commend the work of the local protective associations throughout the State, and assure them that the assistance rendered is ever appreciated. I would also express the gratitude of the Department for the assistance which is rendered by the express companies, which are ever ready to assist in detecting violations by persons who persist in illegally shipping fish and game.

Respectfully submitted.

J. WARREN POND,

Chief Game Protector.



Report of the Superintendent of Shellfisheries 1902

To the Forest, Fish and Game Commission:

GENTLEMEN. — Though frequent treatises upon the shellfish industry of this country have appeared in print and from time to time articles of considerable value concerning this subject have been produced, it remains true that the public generally, and particularly those who reside at points remote from the seacoast, have but faint ideas of its relative importance. Next to the State forests, which conserve the rainfall over a vast area and constitute the reservoirs which equalize the flow of our mountain streams and great rivers, preventing alternate floods and droughts, and preserving the navigability of our waterways, so bringing continued prosperity to commerce and with regularity watering the thirsty land, comes the shellfish industry in importance among the subjects under the care of the Forest, Fish and Game Commission.

Years ago the State of New York adopted a policy calculated to foster and encourage this industry, which, with the threatened exhaustion of the natural beds of oysters and clams, bade fair to continue in but a languishing condition. The result of this system was at once apparent, and so rapidly did the business respond that at a net outlay of little more than \$5,000 per annum from the State Treasury a delicious food product, valued at many millions of dollars, is annually gained for the entire people and is supplying an excellent and cheap item of diet at a time when all other foodstuffs have materially enhanced in price to the consumer. It is one great industry which has not been taken over by a trust, though many attempts have been made to control it, with the result that never have oysters been cheaper than at the present time. The oyster planters' business is at best uncertain and precarious. From the moment the beds under the waters of our sounds, bays and rivers are cleaned, scraped and prepared and the seed planted until the mature bivalve is dredged for market the work is experimental. A severe wind from an unfavorable quarter, with its incidental high waves and shifting sands, may in a few hours blot out the investment and

labor of the year. Starfish may swarm over a well planted and well tilled bed and leave scarcely a living oyster behind. The borer and periwinkle perform their deadly work, and in addition to these known agencies of destruction, there are conditions of water, etc., as yet not understood (as during the present season) which materially affect the output.

The Oyster Crop.

The crop of the present season has been short, though unimpaired in quality, it being stated that the quantity of oysters marketed does not exceed, in bushels, the amount of seed oysters planted. The reason of this condition is obscure and cannot be explained by the planters, who, in consequence of the poor supply, have sustained severe loss, and were it not for the favorable system maintained by the State many of them would have been forced out of business. About once in from five to seven years there occurs in New York waters an abundant set of young oysters. The last extensive set was in the summer of 1899, and in its abundance it was altogether unprecedented. As the oyster requires from three to five years to mature, a few years of plenty follow each general set of young oysters to those planters who industriously cultivate their grounds and are fortunate enough to escape all or most of the many dangers attendant upon the occupation.

The liberal policies of the States of New York and Connecticut in dealing with the shellfish planters have been imitated by other States with like excellent results. Even the States upon the Pacific coast have been giving much attention to the subject. State Fish Commissioner Kershaw, of Washington, is quoted as having said: "Eastern transplanted oysters are coming to the front everywhere. People who never investigated the subject do not know the importance of this fishery question. It is now one of the four great industries of Washington, and ranks with coal, lumber and wheat as a money producer. The oyster business will, in my opinion, soon become more important than other fisheries."

Shellfish Culture.

It may be of interest to describe here something regarding the men engaged in the shellfishing business, and of the methods used by them in this odd style of farming.

There are two classes of oyster planters: The first is represented by the poor bayman who, without capital, cultivates a small piece of ground by his individual

labor, with possibly the assistance of some member of his family or of a similarly situated "partner." There are many hundreds of these who, by arduous toil, while subjected to constant hardship and exposure, manage to wrest from the sand and mud of our bays and harbors a frugal livelihood for themselves and families. The numbers of this type are constantly increasing. Second, the planter with capital sufficient to enable him to use every device and appliance necessary or convenient to large operations, including the employment of well-manned steamers equipped with steam dredges, Starfish mops, etc., together with extensive oyster houses where oysters are opened or otherwise prepared for shipment, whence the product is sent throughout the country, and indeed to all parts of the civilized world.

In commencing, or upon enlarging his business, the first care of the planter is to select a tract of land under water which he believes to be unappropriated and suitable for cultivation, marking out the boundaries by stakes or buoys; he then consults the maps and records in the Shellfish Department of the Forest, Fish and Game Commission for the purpose of determining that the lands in question are open to entry. He is now prepared to make his formal written application for a lease from the State, for which blank forms are provided by the Department, giving, without actual survey, the best possible description of the ground, making oath that the same has not within five years produced naturally sufficient oysters to enable a man by taking them up to make a living, and that he intends, in case a lease is granted, to use the lands for the purpose of shellfish culture only. The application is thereupon filed and advertised during three weeks by posting a notice in each of three places, to wit: in the shellfish office, in the postoffice nearest the location and in the office of the town clerk of the town in which the tract is situated, the time and place of sale of the grant being indicated in the notices. At the expiration of the period of advertisement a certificate is prepared, signed and filed by the clerk of the shellfish office that no objection, or that objection, as the case may be, has been made to the granting of a lease. If no valid objection has been received within competent time, the Superintendent of Shellfisheries and the Surveyor of Oyster Lands unite in a certificate (they having made any necessary investigation of the ground) that the tract is not, or does not include, a bed of oysters of natural growth. At the shellfish office, upon the appointed time, the grant of the lease of the land for the purpose of shellfish cultivation is offered at public auction and awarded to the highest bidder, the minimum price being twenty-five cents per acre per annum. After the lease has thus been granted, the land is carefully surveyed and the boundaries

marked by the State Surveyor of Oyster Lands, who plots the tract upon the maps of the office and furnishes an accurate description for the purposes of the deed of lease, which is then prepared, executed by the Commission and delivered to the lessee. Only inhabitants of the State may become original lessees or hold by assignment of lease.

In certain localities the law permits what are called perpetual leases, or franchises of land under water, for shellfish cultivation.

The Year's Business.

During the past year 125 applications were received for shellfish lands. Of these applications eight were withdrawn, some of them covering ground for which previous applications had been made. Of the remaining applications the lands included in 114 have been leased to the highest bidders, and three are now in process of advertisement. Thirteen hundred and seventy-two and four tenths acres, to be added to the total of lands previously awarded, are included in these 117 applications. The total of lands held under lease and franchise by shellfish cultivators now amounts to 27,252 acres. The lands applied for during the past year are under the waters of Long Island Sound, Raritan Bay, Pelham Bay and Jamaica Bay.

Mr. Charles Wyeth, the Surveyor of Oyster Lands, with an experience of twelve years in this office, has carried forward during the year the surveys and maps of the Department, a work commenced fifteen years ago under the charge of Hon. Eugene Blackford, then Commissioner of Fisheries.

During the past few years the jurisdiction of this Department has by law been extended to the lands under the waters of Pelham Bay. In Hempstead Harbor and Manhasset Bay it has been contended that the lands are controlled by the respective towns. The Attorney-General of the State has, however, examined the questions carefully and advised that the jurisdiction is in the State.

The effect of this enlargement of jurisdiction has been to extend the coastline, adjacent to State shellfish lands, to over 210 miles. Along this entire distance it is necessary to maintain signal monuments, which constitute the basic points of our system of hydrographic surveys. From these the necessary triangulations are made and permanent maps prepared, by means of which the individual oyster tracts are definitely located.

Lobster Fisheries Dispute.

There has been no material change since my last annual report in the position of the residents of the village of Noank in the State of Connecticut, who claim the right to fish for lobsters in the waters of "The Race" in this State. Perhaps the following correspondence between the Superintendent of Shellfisheries and the Attorney-General of the State of Connecticut will make clear the present status of the matter:

OFFICE SUPERINTENDENT OF SHELLFISHERIES,
NO. 1 MADISON AVENUE.

NEW YORK, *July 28, 1902.*

HON. CHARLES PHELPS, *Attorney-General, Hartford, Conn.:*

DEAR SIR.—About two years have passed since the case of the People *vs.* Morgan was instituted. At that time it was claimed upon the part of the Noank lobster fishermen that they possessed a prescriptive right to fish for lobsters in the waters of "The Race," southwest of Fisher's Island, in this State. This right has not been established, though from time to time it has been said that the Connecticut fishermen would institute proceedings to test the question. The only proposals looking to a solution of the matter have proceeded from this Commission, which, in the fall of 1900, in a spirit of heartiest amity, suggested reciprocal legislation upon the part of the Legislatures of the two States, which suggestion was embodied in a recommendation to the New York Legislature of 1901.

Mr. David Welch, who at that time represented the Noank people as their attorney, undertook to draft a proposed law for adoption in both States, which this Commission promised to recommend for enactment in the State of New York. Upon consulting with his clients, Mr. Welch gave up the idea of reciprocity, and reported that the passage of such an act by the Legislature of Connecticut at that time would be "an utter impossibility." It does not appear that the question is any nearer being solved than at the beginning.

There is nothing pending upon which this Department can act, and as numerous complaints are made that our shellfish non-resident law is not properly and equally enforced, we cannot with fairness ask our protectors to overlook violations.

I beg to assure you of our most friendly disposition and entire readiness to take up any promising measure which you may propose, and which will involve not merely inaction by this Department in the execution of the law.

Appreciating your many courtesies, I am, with kind regards, yours respectfully,

B. FRANK WOOD,

Superintendent of Shellfisheries.

STATE OF CONNECTICUT,
ATTORNEY-GENERAL'S OFFICE.HARTFORD, *July 30, 1902.*HON. B. FRANK WOOD, *State Superintendent of Shellfisheries, New York:*

DEAR SIR. — Your favor of July twenty-eighth, concerning the matter of the Noank lobster fishermen, is received.

I regret with you that results in the adjustment of the difficulties appear to have been delayed. I hope now, however, that some progress will be made at an early date.

The services of Mr. Hadlai A. Hull, a prominent lawyer of New London, have been secured to bring the matter, if possible, to a speedy and amicable termination. Mr. Hull's location and experience, I understand, will be of special advantage to all parties concerned. I received a telephone message from him on Monday that he was about to have an interview with your Mr. Overton, and consequently I sent him a copy of your letter of July twenty-eighth, and you will no doubt hear from him personally or through Mr. Overton.

I realize your position in the matter, and I desire to acknowledge my appreciation of your most friendly disposition and continued courtesy concerning the subject in question.

Thanking you for past favors, I remain, very truly yours,

CHARLES PHELPS,
Attorney-General.

It has been customary to distribute annually from the State Hatchery at Cold Spring Harbor, in the waters of Long Island Sound, from 2,000,000 to 3,000,000 young lobsters. During the past year this work was necessarily abandoned as the Department had no boat which could be used for the purpose. The naphtha launch belonging to the Commission, not being a sea-going craft, was taken from the waters of the coast and is now in use upon the inland waters of the State. In many directions the work of this Department has been hampered by lack of a suitable boat, and it is hoped that one may be provided for use upon our coast and bays. Such a boat would be constantly employed in doing necessary work.

The Menhaden Catch.

The Fisheries Company reports that the Menhaden catch during the season of 1902 has amounted to 1,375,786 barrels, from which was obtained 55,000 barrels of oil, 11,000 tons of dried scrap and 32,000 tons of acidulated scrap. Not only has the catch been large, but the price also larger than last year. It is said

that the catch of the year now closed has not been equaled in twenty years, and fully fifty per cent more fish might have been taken had the factories been of sufficient capacity to handle them. It has been determined that food-fish and Menhaden do not school together, scarcely enough food-fish being taken by the Menhaden steamers to supply the wants of the crews in that direction. The United States Fish Commission caused a searching investigation to be made, with a view to determining this question, and has reported as above. Regarding the periodical scarcity or abundance of food-fish many theories have been advanced, but no good reason has appeared for the sudden changes from scarcity to abundance and vice versa. Those who, from experience and study of the subject, would be deemed most competent to answer such questions, say that it is beyond the power of man to explain why fish, after having been supposed to be almost extinct along certain lines of coast, will suddenly appear in great quantities. The difficulty of regulating the ocean fisheries by legislation is therefore apparent, and serious results are apt to follow such attempts.

Respectfully submitted.

B. FRANK WOOD,

Superintendent of Shellfisheries.



Ninth Report
of the
Forest, Fish and Game Commission

Albany, N. Y., January 18, 1904.

Hon. S. Frederick Nixon,

Speaker of the Assembly:

Sir.—We have the honor to submit herewith, as required by law, the official report of this Commission for the year ending September 30, 1903.

Very truly yours,

Dewitt C. Middleton,

Commissioner,

J. Duncan Lawrence,

Deputy Commissioner.

State of New York

Forest, Fish and Game Commission.

Dewitt C. Middleton, Commissioner, - - - - - Watertown, N. Y.
J. Duncan Lawrence, Deputy Commissioner, - - - - - Bloomville, N. Y.

Secretary, - - - - - John D. Whish, Albany, N. Y.
Superintendent of Forests, - - - - - William F. Fox, Albany, N. Y.
Chief Game Protector, - - - - - J. Warren Pond, Albany, N. Y.
Superintendent of Shellfisheries - - - - - B. Frank Wood, Jamaica, N. Y.

Report

of the

Forest, Fish and Game Commission

1903

To the Honorable the Legislature:

IN transmitting the Ninth Report the Forest, Fish and Game Commission calls your particular attention to the facts and statistics presented, which are calculated to show the actual value received by the people from that portion of the business of the State entrusted to its care.

Every department (Forestry, Fisheries and Game Protection) is productive of some return, and in each case the income is greater than the appropriation made annually for its support.

The Adirondack forest, concerning which a separate and more extended report will be presented to your honorable body later in the session, is a source of great revenue to at least ten of the counties of the State, and the purchase of land in this region has been a most valuable investment. Up to January 1, 1903, the State had paid for Adirondack lands, exclusive of tax sales, \$2,329,101.60. The receipts from visitors to this region during the year 1903 amounted to \$3,999,139. This large sum of money was distributed directly to the people, and was spent by thousands of visitors who sought the forest for rest, recreation or health.

Within the woodland territory in particular, and also in many other localities, are located almost innumerable lakes and streams which are stocked liberally from the system of fish hatcheries which the State has established. To these waters flock annually thousands of fishermen who are able and willing to spend money freely in pursuit of their favorite pastime. It is no longer disputed that the continual replenishing of our waters with fish is necessary to keep pace with the steady growth of our population. Without such attention as is given to public waters by the Commission, it is conceded by those who have studied the problem

that a most desirable and comparatively inexpensive variety of food would speedily be lost to the people, not to mention the loss of a form of recreation that finds favor with thousands of sportsmen whose requirements have created industries which produce goods worth great sums annually and which give employment to an army of workingmen. The hatchery system, maintained at a moderate cost, returned last year in the actual market value of the fish produced more than three dollars for every dollar spent for its maintenance. The value to the people of the inland fisheries thus fostered amounts to hundreds of thousands of dollars annually, as the statistics show.

In the Department of Shellfisheries, to which careful supervision is given by the Commission, an even greater value is shown by the returns. The figures given indicate that the business done amounts to nearly \$7,000,000 yearly, that this results in the payment of over \$250,000 in wages, and that vessels are employed in the work worth over \$600,000. The amount of money spent by the State for the care of this great industry is very small in comparison with the results secured.

Similar remarks might be made with reference to the work of protection, which gives employment to a limited number of experienced men whose constant watchfulness is necessary to prevent infractions of the law, and whose work is productive of much good to all the interests concerned.

Finally, the Commission makes no recommendations for legislation, believing that this may well be left to the representatives of the people in the Senate and Assembly. Your attention is, however, respectfully called to the suggestions contained in the appended reports of the Superintendent of Forests, the Superintendent of Shellfisheries, the Chief Protector and the Hatchery Foremen. To such enactments as your honorable body may be pleased to make, and which receive Executive approval, our best attention will be given.

BY THE COMMISSION.

JOHN D. WHISH,
Secretary.

Report of Superintendent of Forests

1903

To the Forest, Fish and Game Commission:

GENTLEMEN. — I respectfully submit herewith my annual report in relation to the work of the Forestry Department and such other business as was entrusted to its care during the past year. Owing to the prolonged drought last spring, together with certain causes beyond the control of the Department, the forest fires at that time were the most extensive and destructive of any that have occurred since the organization of the Forest Commission. Other States also suffered serious losses, the extent of the burned areas and destruction of timber in some of them exceeding that in New York.

Forest Fires.

The woodland fires in the Adirondacks generally occur in April and May. At this time of year the ground in our forests is covered with a thick layer of dead leaves, which, with the first warm sun and south wind, become so dry that a single spark will ignite them and start a blaze that will immediately spread in all directions; or, under the influence of a strong breeze, travel rapidly over brush lands and through the timber belts. If in its course it reaches the slash or dry refuse of an old lumber job, the flames cannot be controlled, and the fire increases in its headway and intensity.

In June, or after the hardwood trees are in full leaf, there is little danger. Fires occur but seldom then; and if they do they cannot run far, as the dense shade and leafy undergrowth retain moisture and promote conditions that prevent any serious damage. During the last eighteen years we have had but one serious fire in the summer—that of 1899—which was due to the extraordinary heat and prolonged drought in August and September of that year. The fires at that time occurred mostly on open, waste lands; and it was noticed that in many places their progress was arrested when they reached a body of green timber. But in

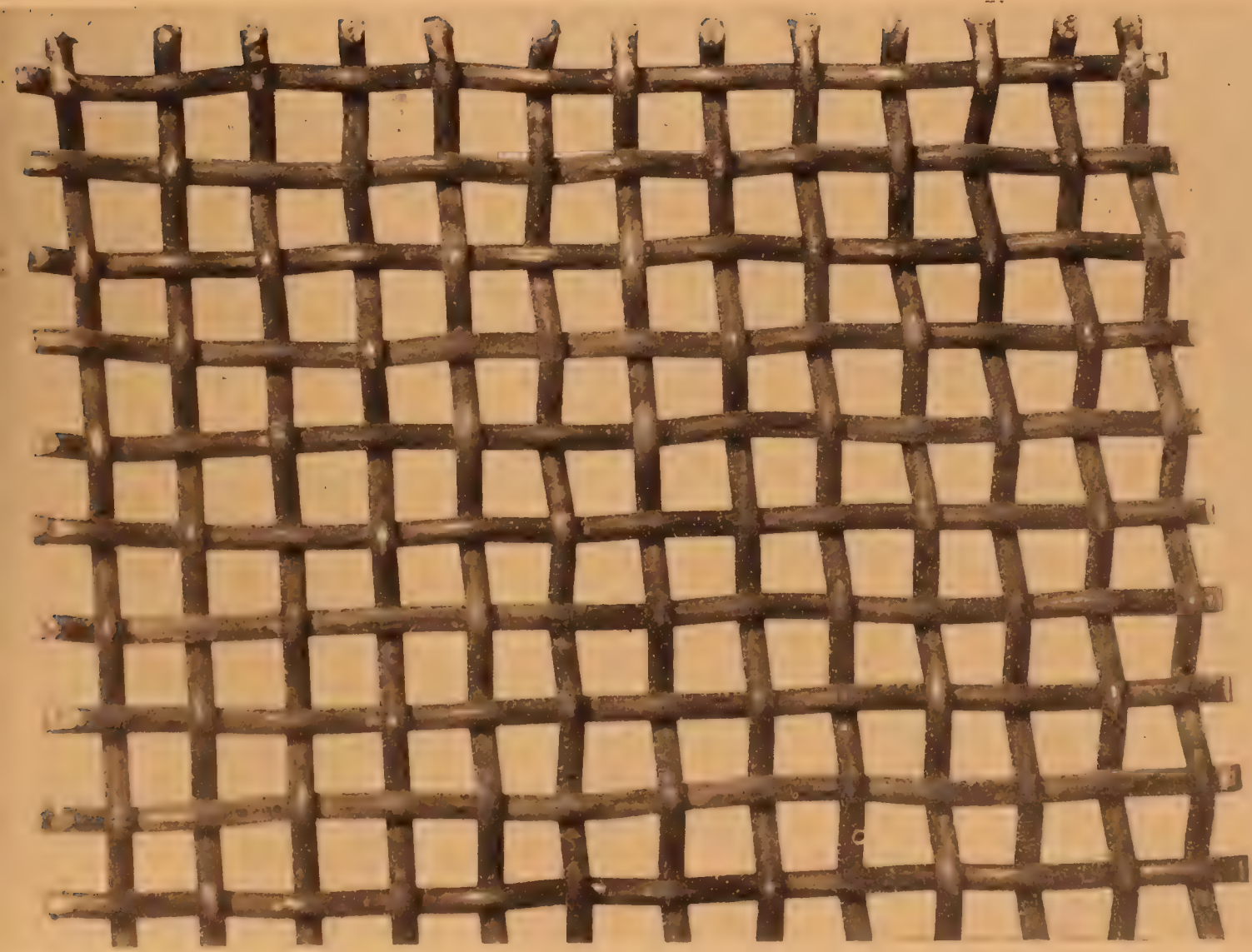
April and May of every year, when the trees and undergrowth are bare, the mass of dead leaves, stumps and fallen tree trunks are exposed to the sun and drying action of the wind, rendering them highly inflammable and ready to burst into flames wherever a spark may fall or a camp fire be carelessly left burning.

No rain, except slight local showers, fell in the Adirondack region from April fourth to June eleventh. The month of May was the driest in seventy-seven years—since 1826. In Albany the rainfall was only fifteen one hundredths of an inch, and it was still less in Northern New York. Combined with the lack of rain there was an unusually high temperature, the month of May showing an accumulated excess above the normal of eighty-nine degrees. On May sixth and nineteenth the temperature at Saranac Lake was in the eighties. On the twenty-seventh the mercury stood at eighty-five degrees, with a strong south wind blowing; and on June sixth and seventh it reached over ninety degrees in the shade.

In the early spring this year, soon after the ground was free from snow, several small fires occurred; but as usual in other years these were quickly extinguished by the firewardens and their men before the flames had attained any headway or done any damage. In the latter part of April forest fires broke out with alarming frequency along the lines of the New York Central, the Chateaugay, the New York and Ottawa, and the Saranac and Lake Placid Railroads.

At first the firewardens extinguished these railroad fires wherever they appeared, but the locomotives continued to throw sparks and start fresh ones faster than the men could attend to them. The dead leaves, bushes, undergrowth, stumps, logs and leafless trees became so dry that it was only by the utmost exertion, combined with skillful, experienced methods, any one fire could be controlled. The conditions were such that incipient fires sprang up in the wake of nearly every railroad train. The line of the New York Central, from Fulton Chain to Mountain View, was bordered with smoke and flames, except on the eight-mile stretch through the private preserve of Dr. W. Seward Webb, where a large number of patrols were employed at his expense to follow each train, night or day, and extinguish the locomotive sparks that fell along the road.

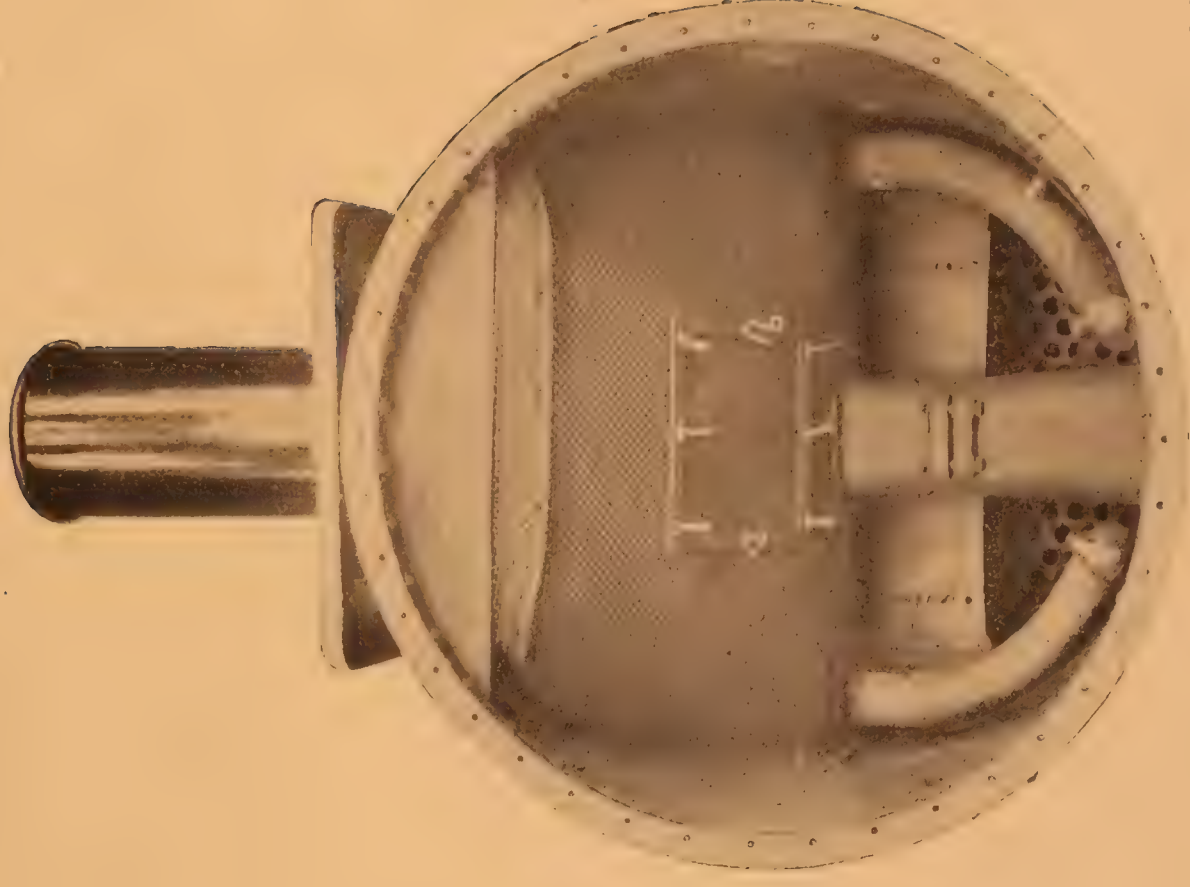
A question may arise here: Why did not the firewardens do the same? But the law defining their duties does not permit them to employ men until a fire is seen; it makes no provision for patrolling, or for the prevention of fires. Nevertheless, when it became evident that patrolling was absolutely necessary to save the remaining forest in certain localities, orders were issued to watch the railroads at these exposed places, after which few new fires started along the tracks, and the larger gangs of men were employed in fighting those which were already burning.



A. KNECHTEL, PHOTO.

SECTION OF SPARK ARRESTER. ACTUAL SIZE.

PATTERN OF SCREEN IN GENERAL USE ON LOCOMOTIVES OF THE ADIRONDACK
DIVISION, NEW YORK CENTRAL RAILROAD.



A. KNECHTEL, PHOTO.

SPARK ARRESTER, OR SCREEN, IN LOCOMOTIVE.

THE MANHOLE IN THE CENTER HAS A MESH OF THE SAME
SIZE AS THE REST OF THE SCREEN.

Another disastrous condition existed in the wind, which was blowing steadily most of the time, generally from the northwest, and which on April thirtieth became a furious gale that filled the air with sand and gravel, forcing travelers on the highways to seek shelter, and pelting the buildings with a sound like that of driving hail. The wind carried sparks and burning brands from the railroad fires a long distance through the air and started fresh flames miles away. The dry condition of the forest generated an intense heat when once fairly aflame, rendering it extremely difficult and dangerous to approach a burning area except on the safe side. In the fire on Township 41, where the large trees grew close to the side of a quiet pool in the inlet of Big Moose Lake, the burning timber threw out a fierce heat that raised the temperature in the pool so that its surface was strewn thickly with dead Trout. These were the conditions under which the firewardens and their men were obliged to fight in the fires of 1903.

At the first outbreak of the trouble the attention of the railroad authorities was called to the dangerous conditions existing along their respective lines, whereupon they issued orders that the screen on each locomotive should be inspected, and that defective ones should be repaired immediately. Still, the engines continued to throw sparks and ignite the dead grasses along the track, or kindle flames in the dry brush and fallen leaves along the boundaries of the adjacent forest. As the resident population was too small in numbers to cope successfully with the increasing fires, the New York Central sent several carloads of Italian laborers to assist in the work along their line, for which no charge was made to the town or State. The superintendent of the Adirondack Division, in compliance with a request from this Department, placed patrols, one man to the mile, on the Saranac branch in order to protect the State plantation of 700 acres near that portion of his line. Freight trains were divided and run in two sections for the purpose of lessening the load on the engines and thereby decreasing the force of the exhaust; and on May seventh orders were issued discontinuing some of the freight trains temporarily in hopes that rain would soon relieve the situation.

But the officials of the Saranac and Lake Placid Railroad made no apparent effort to lessen the danger from their trains, and manifested a surprising indifference when notified of the destruction caused by their locomotives. The great fire which at one time threatened the hotels at Lake Placid, and burned over an area of several square miles, was started by a locomotive on that road. At this time a construction company was engaged in the work of widening the gauge of this line and making a new roadbed in places. In the performance of its contract this company employed some small engines—such as are used by contractors in railroad building—which were evidently starting some of the fires along that line as well as

the locomotives on the regular trains. The Chief Firewarden, Mr. L. S. Emmons, while watching one of these construction engines, saw two fires start up behind it immediately after it passed by. On its return he stopped it, examined the stack, and found it without a screen of any kind. He compelled the engineer to put one on before going any farther; but he could not arrest the man, because the section in our fire law relating to railroads makes no provision for any such action. Under the law he could only sue the engineer in a civil action, and, if successful, recover \$100. But he would have the railroad company to contend with instead of the individual as the actual defendant, the case would be appealed to the higher courts, and years might elapse and thousands be expended by the State before he got the hundred dollars.

Although the railroad officials claimed that every locomotive was properly screened in compliance with the law, there were nights when the usual quantity and size of the coals thrown from some stack could be plainly seen in the darkness, and indicated that the appliance was not in good condition.

On the other hand, we had cases like this: A fire was started May thirteenth near Colby Pond, Franklin County, by sparks from Engine No. 683 of the New York Central Railroad, which destroyed several hundred acres of timber. A forestry official immediately obtained permission to examine the screen of this engine, but he found it unbroken and in proper condition. Most of the iron netting used for locomotive screens has a mesh five sixteenths of an inch square, or two and one half openings to the linear inch; and experts assert that a locomotive cannot "make steam" with a mesh of smaller size. Still, live coals as large as a pea will be thrown by the exhaust through nettings of this pattern. The screens are not placed in the stack, as many suppose, but are bolted firmly to a framework in the forward extension of the boiler. The sparks and live coals from the flues or tubes first strike a solid wrought iron shield, which slopes downward at an angle of forty-five degrees, and are deflected to the bottom of the smoke box, after which such as are carried upward by the draft strike the screen, which slopes upward and forward, and, with the exception of the smaller ones that go through this netting, fall back. But in the little engines used by the contractors on construction work—such as the ones just referred to—the screen is in the stack.

On the nineteen miles of the Raquette Lake Railway, running through the State forest from Clearwater to Durant, no fires occurred, because in granting a charter for this road the Legislature stipulated that the locomotives must use petroleum for fuel.

The railroad officials expressed themselves as anxious to do everything practicable to prevent the starting of fires by their locomotives, as the company is legally

responsible for all damages arising from this source. They also manifest an interest in forest preservation because their summer traffic is dependent on it.

Our present law is insufficient in its provisions to prevent a recurrence of these railroad fires, and the only remedy lies in an amendment compelling the companies to use electric motors or petroleum burners; or, failing to do this, to patrol their lines during the dry season with a sufficient number of men to extinguish the live coals and sparks wherever they may fall outside the tracks.

In the forests of Germany, although traversed most everywhere by railroads, there is no loss caused by locomotives; at least the fires from this source are so few and far between that the woodlands of that country are practically exempt from this evil, a fact often alluded to in discussing the damage to woodlands caused by railroads in the Adirondacks. But it must not be inferred from this that the widespread destruction of standing timber caused by the railroads in Northern New York is due to any inefficiency on the part of the forest management. The conditions differ widely from those which exist in the European forests—conditions beyond the control of the Department.

The locomotives in Europe throw sparks the same as here. But in a German forest, where timber cuttings have been made, there is an entire absence of tree-tops, limbs and brush. All this is removed when the timber is taken out, leaving the forest floor clean and free from inflammable material. Moreover, there is scarcely any undergrowth aside from the seedlings which are to furnish the future crop, while in some forests even these are not found, the ground being as free from litter or young growth as a city park. The right-of-way along the railroads is cut out to a greater width than in our State, and is entirely free from logs, stumps and bushy growth. Except in mountainous districts, the land between the railroad tracks and the adjoining forest is ploughed, leaving a broad strip of fresh, upturned earth over which a creeping fire cannot pass. Where the right-of-way is wide enough two strips of fresh earth are thus exposed, which are connected at short intervals by cross-ploughing, thereby preventing a fire running lengthwise in the grass between the strips. A good example of this may be seen by tourists in traveling along the railroad from Heidelberg to Darmstadt. I mention this route in particular as so many of our summer tourists travel that line. For many miles this railroad is bordered on either side by contiguous forests of Scotch Pine, a highly resinous species. The ground is level, sandy and easily ploughed.

But in our Adirondack forests we have entirely different and more dangerous conditions. The forests along the railroad lines, owing to their accessibility, have all been lumbered recently, and the ground is covered waist deep with dead tree-

tops, limbs and dry brush. When a surface fire starts at the railroad track and reaches this mass of tinder a furious conflagration ensues, which can be extinguished only by the most arduous work and at great expense. It is useless to talk about ploughing along our railroad lines as done in Germany. Any one who has traveled over the line of the Adirondack divisions and noted the topography will readily understand the difficulties of attempting such a method. In place of the level, sandy soil, so often found in European forests, there is a rocky, uneven surface interspersed with stumps, the right-of-way presenting a succession of steep knolls and depressions. Even if the stumps were grubbed out by the roots the broken rock, which crops out everywhere, renders ploughing impracticable.

Furthermore, it is doubtful whether any law could be passed, even if it were constitutional, that would enable the State to dictate to the lumbermen as to how they should conduct their business on private lands. The lumberman cannot convert his tops and limbs into money, as is the case in Germany; neither do we have the peasantry, who would go into the woods afterwards and clean up every faggot and little twig. The time will undoubtedly come when, with a scarcity of wood and higher prices, our forests will be exploited in as safe and intelligent a manner as abroad. But until then we must recognize existing conditions, and in our forest management modify them as best we can. Any talk about European forestry with reference to our railroad fires is therefore a waste of time, and any indulgence in it betrays an ignorance of the actual situation.

But all the Adirondack fires did not originate along the railroads; there were other causes at work. At this season of the year there are a large number of fishermen in the woods, many of them belonging to a careless, shiftless class, unworthy the name of sportsmen. They employ no guides, but straggle aimlessly through the forests, camping out wherever night overtakes them. As they move on from place to place they generally leave their camp fires burning; when they make coffee at noon they make little or no effort to extinguish the small fire kindled for that purpose. With the woods as dry as they were last spring, several fires, which started up in remote, unfrequented places, were fairly attributable to fishermen of this class, some of whom were reported as having been seen in these localities.

Hitherto we have had but little success in prosecuting these offenders, because it was so difficult under the circumstances to secure the positive evidence necessary to conviction. The local juries, too often in sympathy with the defendant, refuse to render a verdict for the State on presumptive evidence merely. The only remedy for this evil is the employment of patrols in sufficient numbers so that each fishing party may be followed and closely watched. This plan may



H. G. STEVENS, PHOTO.

A BEECH FOREST IN NORTHERN PRUSSIA.

THE PILE OF BRUSH IN THE FOREGROUND SHOWS HOW THOROUGHLY THE GROUND IS CLEARED OF INFLAMMABLE MATERIAL. A RAILROAD RUNS THROUGH THIS FOREST.



H. G. STEVENS, PHOTO.

FOREST OF FRIEDRICHSRUH, GERMANY.

THIS FOREST BORDERS ON A RAILROAD; BUT NO FIRES OCCUR, FOR THE LIMBS AND BRUSH ARE ALL REMOVED WHEN THE TIMBER IS CUT. THE LOW STUMPS SHOW WHERE THE TREES WERE REMOVED.

be expensive, but it would be far cheaper than fighting the fires which otherwise will occur.

With few exceptions the private preserves escaped damage, for the lands of this description were thoroughly patrolled by men in the employ of the owners. A notable exception, however, was the Rockefeller Preserve, through which the line of the New York and Ottawa Railroad runs for several miles, which was burned extensively by fires started by locomotives before measures were taken to thoroughly patrol the road.

As in previous years, some of the burned area was due to farmers who kindled their brush or fallows in violation of the law forbidding agricultural work of this kind between April first and June first. But each offender of this class, as shown farther on in this report, was arrested and punished.

Some conflagrations were started by incendiaries and degenerates, prompted by malice, revenge, or criminal instincts. It has been alleged that some fires were set by men in order to get employment, but no evidence whatever has been furnished thus far in support of this theory. The rate of wages for fighting fire in each town is fixed by the town board of auditors, not by the State. The price varies in the different towns from one dollar and twenty-five cents to two dollars per day. The work, when properly performed, is the hardest and most exhaustive that men are ever called upon to do, and the wages paid are none too high for the services rendered. In view of the scarcity of labor and high wages in the Adirondacks there was little or no need of any one becoming an incendiary in order to get work. A man who would set fire to the woods is a criminal in every sense of the word. Now, a criminal will commit crime in order to evade work, but not to get work. The arduous service required by the firewardens offers no inducement to men of this character. It is granted that bad men will burn the woods through motives of revenge, but hardly to get honest employment. In each case where a man was convicted of incendiarism last spring it was noticed that he had not applied to any firewarden for employment. Furthermore, the towns, as a rule, do not pay immediately, but wait until the boards of supervisors meet in December to apportion the money for the payment of their fire accounts and other expenses, and these payments are delayed still further until the taxes then levied can be collected. Every man in the Adirondacks knows this, for the delay is a matter of common complaint. I am aware that some of the lumber companies paid cash down to the men who protected their property at this time, but as these men were called from other work for this purpose they did not have to light brush heaps in order to get a job. Even if it should appear conclusively that some man had kindled the woods in order to get work, it would be absurd to abandon the employ-

ment of men for fighting forest fires on that account, for men will not perform the hard labor necessary for the protection of forest property without pay. If, as claimed by some, the rate of wages is unnecessarily high in this service, the auditing board of each town has the remedy in its own hands. I have discussed this matter before in previous reports, and regret that it seems necessary to allude to it again.

Another serious condition which confronts our forest management in the Adirondacks is the ever increasing number of residents. I do not refer to our summer hotels and their patrons. The trouble is caused by the farmers who are carrying on agricultural operations of a minor character, and by the large number of men who remain in the region after the lumbering operations on which they were employed have ceased. Fifty years ago, when there were scarcely any people in our woods, forest fires were almost unknown. Fires do not start spontaneously; some man or railroad is responsible for them in every case. The more railroads we have the more of the idle, shiftless class come in, hence the greater the danger to our woodlands. It is to be hoped, however, that the State in carrying out its policy of acquiring lands will purchase the holdings of the small farmers, together with other petty interests detrimental to the safety of forest property, and thereby minimize this prolific source of evil.

Though an unpleasant duty, attention is called to the laxity of public opinion which prevails in certain parts of the Adirondack region as to the cause of forest fires. In nearly every village there is a disreputable class whose presence is inimical to the preservation of our forests. They are the men who, having been arrested at some time for violation of the Game Law or timber stealing, have a grievance against the authorities. They hang around hotels or taverns and when any so-called "State man" is in hearing, delight in making threats that, "The State has got to look out or there will be more fires in the woods," to which the bystanders listen with smiles or nods of approval. It is discouraging to post the rules and regulations regarding the use of fires only to have them torn down by a fellow who afterwards struts around some barroom bragging of his exploit. Nor is this all. It frequently occurs that when a farmer wilfully burns his fallow in defiance of the law and warnings of the firewarden, thereby destroying the adjacent forest, the citizens refuse to furnish evidence of the crime, although they are fully cognizant of the facts.

Aside from the railroads, the remedy for this evil lies with the residents themselves. It rests with them to create a healthy public sentiment that will prevent the careless and criminal use of fire. If the taxes caused by the expense of

protecting forest property in the town become burdensome, they are largely responsible for it; and instead of spending their time in useless complaint they can utilize it better in remonstrating with the men who carelessly or wilfully violate the law.

Whatever the causes of the fires may have been, there was no remissness or inefficiency on the part of the firewardens in attacking them promptly and energetically wherever they broke out. Everything was done that human activity and experience could accomplish. I heard some unfavorable criticism at times, but it came from persons who were hanging around hotels, stores or railroad stations—men who refused to work when ordered out, preferring to spend their time in finding fault with those who were at work, and in explaining to each other how the thing should be done. There are 132 town firewardens appointed by the Commission, each one of whom appoints district firewardens in his town, making 661 in all. In this large number there undoubtedly are some who are not as competent, or as well adapted to the work, as could be desired. But so far as I can learn each one of them did the best he could.

As the fires increased in number it became difficult to get men enough to fight them. The railroad companies brought in large gangs of laborers from outside the woods to work along their lines, but that did not relieve the situation at other places. A great many who had turned out willingly and fought fire at the start abandoned the work after a while, explaining that they could not afford to labor any longer and wait on the town nine months for their pay. I then made an arrangement with some of the lumber companies, whose lands were in danger, to send in all the men they could spare from their jobs and to advance the cash needed to pay them promptly, the companies to wait for reimbursement until the towns could settle the account. Under this agreement a large number of experienced woodsmen were set to work.

But this did not help materially in protecting the great areas of State forest in which there was no resident population, and in which no one had any individual interest. Everywhere, with few exceptions, men refused to fight fire on State land if they had to depend on the town for their money. In this emergency I applied to Governor Odell, who promptly requested the Comptroller to place \$15,000 at the disposal of the Commission. With this fund available we were able, whenever a fire broke out in the Preserve, to quickly hire a gang of selected men and set them to work. Of the total burned area in the Adirondack and Catskill forests only twelve per cent was State land, this low percentage and immunity from extensive loss being due largely to the assistance rendered by the Governor.

There seems to be an impression on the part of some people that the efforts of the firewardens were of little avail, and that the termination of the fires was due solely to rain. This is an error to a great extent. The rain was certainly a great blessing, but when it finally came, on June eleventh, the greater part of the fires had been extinguished, or were under control, although the burned area in many places was still smoking. By the phrase "under control" I mean that the wardens had reported that these fires were completely corralled, and that a crew was on watch to prevent any fresh outbreak.

In many cases, as just stated, the flames were completely extinguished—the one on Township 41, for instance, which occurred on State land in a heavily timbered Spruce forest that had never been lumbered. In other places, where the progress of the fire had been effectually stopped, the burned area continued to smoke and smolder, owing to the extraordinary dry condition; but the ground was closely guarded, and whenever there was any indication that the wind might cause a fresh outbreak measures were taken to prevent it.

A noticeable example of good work was seen at Fulton Chain Station, where by judicious back-firing and effective work a general disaster was averted and the village saved from destruction. Also on Township 28, Hamilton County, the lumber crews, acting under the direction of Mr. John Anderson and the Chief Firewarden, after working night and day, stopped a large fire that threatened at one time to sweep over the entire town. Many other instances could be cited if necessary where extensive and dangerous fires were fought to a standstill without the aid of rainfall.

Though they extinguished many fires new ones were starting continually, hence the question may arise as to why this was permitted. But under the weather conditions no earthly power or organization could prevent this evil when locomotives were daily kindling fires in the dry grass along the railroads, and wandering fishermen were leaving their smudge and coffee fires burning in the woods uncared for. The city of Chicago had a model fire department, but that did not prevent the great catastrophe in 1871, when a large portion of the city was destroyed by fire. And so the firewardens of Northern New York, energetic and efficient as they are in fighting fire, have to work under discouraging conditions so long as the railroads and careless natives are continually firing the woods.

Every effort was made to enable the gangs to work to good advantage. The best time to check a large fire is early in the morning—at daybreak—for the flames die down in the night. The air then is cool and damp; there is little or no wind. Where a fire occurred at any considerable distance from a camp or boarding-



A. KNECHTEL, PHOTO.

PACKING IN FOOD FOR THE FIRE FIGHTERS.



A. KNECHTEL, PHOTO.

THE FIRE FIGHTERS' COOK.

PREPARING SUPPER FOR A PARTY OF MEN WHO ARE FIGHTING FIRE IN THE WOODS CLOSE BY.

house, the crew was ordered to remain there all night and sleep on the ground, arrangements having been made at the same time to send in food and blankets to them. This involved no hardship, as the men were used to camping out; moreover, the nights, with one exception, were warm, and there was no rain. In each case of this kind the firewarden was ordered to make a contract for food supplies and some simple camp equipment at the nearest store, lumber camp, hotel or boarding-house, and to detail one or more men with pack-baskets to carry in this material. Under this plan many fires were checked and extinguished which could not have been controlled by fighting them in the daytime only and allowing the crew to leave their work at a critical time to go some distance for meals and lodging. Expenses thus incurred, as well as the wages of the men, were assumed by the towns.

Some idea of the activity with which the work was carried on is attested by the fact that 6,487 men were ordered out by the wardens, and that the total number of days worked at the fires in the Adirondacks amounted to 77,290. Moreover, there was only a sparse population to draw from. Hamilton County, one of the largest in the State, has only 4,947 people all told — men, women and children.

Had it not been for the active, efficient work of the wardens and their men during this prolonged drought, the numerous fires would have coalesced — “run together,” as it is termed — and the Adirondack forest would have been destroyed, leaving nothing but a bare and blackened ruin throughout its entire extent.

A careful tabulation of the firewardens' reports of each and every fire enables me to submit the following result:

ADIRONDACK FOREST FIRES.

1903.

Acres of timber land burned	292,121
Acres of brush land burned	172,068
Value of standing timber destroyed	\$666,207
Value of logs, pulp-wood, etc., destroyed	145,457
Value of buildings burned	34,418
Total number of days' labor	77,290
Acres of State timber land burned*	33,698
Acres of State brush land burned†	24,420

* Included in first item. † Included in second item.

CATSKILL FOREST FIRES.

1903.

Acres of timber land burned	20,469
Acres of brush land burned	15,860
Value of standing timber destroyed	\$29,075
Value of pulp-wood, etc., destroyed	7,934
Value of buildings burned	25
Total number of days' labor	4,492
Acres of State timber land burned *	100
Acres of State brush land burned †	65

LOSSES BY COUNTIES.

ADIRONDACK REGION.

COUNTIES.	Total days' labor.	Acres of timber land.	Acres of brush land.	Value of standing timber destroyed.	Value of logs, pulp-wood, etc., destroyed.	Value of buildings, fences, etc., burned.
Clinton	969	2,290	3,470	\$5,020	\$775	\$280
Essex	10,794	32,755	24,701	55,870	35,335	16,895
Franklin	26,678	84,081	45,287	179,272	73,247	5,198
Fulton	810	2,155	1,185	2,890	100	75
Hamilton	11,882	54,317	6,638	257,550	2,746	7,115
Herkimer	5,589	15,895	8,315	40,280	15,171	450
Lewis	5,285	20,990	15,258	30,800	4,650	985
Oneida	1,397	4,665	4,720	4,500	304	900
St. Lawrence	10,221	68,076	58,974	75,260	12,532	2,380
Saratoga	271	196	780	1,400	.	140
Warren	2,534	6,091	2,376	11,765	562	.
Washington	860	610	364	1,600	35	.
Total	77,290	292,121	172,068	\$666,207	\$145,457	\$34,418

CATSKILL REGION.

Delaware	1,387	3,694	3,231	\$3,185	\$5,511	\$10
Greene	921	1,237	1,207	4,270	120	.
Sullivan	1,775	13,170	8,884	21,215	2,138	15
Ulster	409	2,368	2,538	405	165	.
Total	4,492	20,469	15,860	\$29,075	\$7,934	\$25

* Included in first item. † Included in second item.

The area burned over, as reported by each firewarden, was carefully proved or corrected by referring to the recorded acreage of each lot mentioned in his report. At the same time no deduction was made for the fact that on many lots the fire ran across in streaks, a part or parts of the tract thus escaping damage. For this reason the area reported exceeds somewhat the actual acreage damaged.

In estimating the value of the standing timber destroyed the firewardens were cautioned against placing it any higher than the market price per acre at which these lands had been selling. The percentage of virgin forest was small. By far the greater part of the timber burned was on what are known as lumbered lands, such as the State had been buying for one dollar and fifty cents per acre, but which, through the recent rise in value of this class of property, are now worth from two dollars to three dollar per acre. Some lands of this class, situated near a railroad, or otherwise accessible, are worth more.

The firewardens were also directed, in making their estimates, to deduct the value of standing timber that was killed, but which was still available if cut within a year or so, for timber, pulp-wood or cordwood. A large proportion of the timber included in the reports was damaged by what are known as ground or surface fires, which killed the trees without consuming any part of them. Where this damage occurred on private lands the owners have been busy all this season in cutting their dead trees, leaving their live timber for future operations. Consequently this large amount of salvage has reduced the estimate of loss materially.

But on the State lands the standing timber killed by the fire, though still in marketable condition, will result in a complete loss, as the Attorney-General has rendered an opinion that, owing to the restrictions in the forestry clause of the Constitution, this material cannot be cut or removed. This state of affairs is also unfortunate, because these areas of dry, dead timber and slash are very liable to take fire again and burn with uncontrollable fierceness.

The loss in buildings, fences, etc., includes the large hotel south of North Elba, known as the Adirondack Lodge; the Loomis Camp, on Little Tupper Lake; several miles of wire fence on Nehasane Park, and several barns or outbuildings at various places.

The loss in logs, pulp-wood, etc., includes the large amount of acid wood that was cut and piled on the lands of the Brooklyn Cooperage Company; several thousand cords of pulp-wood and cordwood, belonging to the Chateaugay Iron and Ore Company, piled at Plumadore Station, Franklin County; numerous skidways of logs left in the woods last winter through lack of snow, and piles of cordwood in forests near villages or shipping points.

There was also a loss in the burning of young trees and seedling growth; in the destruction of the forest humus, and in the creation of barren conditions that prevent, in a great degree, the natural reforestation of the denuded lands. But no estimate could be made of consequential damages or prospective losses.

CAUSES OF FIRES AS REPORTED.

Railroad locomotives	121	Wintergreen-pickers	3
Burning fallows	88	Lunatic	1
From other fires by wind	61	Dooryard fire	1
Fishermen	47	Children at play	1
Tobacco smokers	23	Smoking out a hedgehog	1
Hunters	7	Burning a straw bed	1
Incendiaries	6	Burning brakes (ferns)	1
Camp fires	6	Blasting stone	1
Burning buildings	3	Sparks from torch	1
Sparks from chimneys	3	Lightning	1

There were the usual large number reported as "Cause unknown," many of which were started by sparks carried through the air a long distance from other fires, and several that probably were caused by locomotives, as they began at some railroad line.

As in other years, a number were started by farmers who took advantage of the dry spell to burn their fallows; but with a few exceptions these did not result in serious damage. They occurred mostly at places where there was a resident population, and hence were seen immediately by some district warden and quickly extinguished.

The law prescribing a close season, in which the farmers are forbidden to burn their brush or log heaps, has been in operation but a few years. During this time, however, copies of this section of the law, printed on cloth, have been posted conspicuously throughout the entire region. Several thousands of these notices for posting, or replacing those that have become defaced or weather-beaten, are sent each year into the forest districts by the Commission. Ignorance of the law is no excuse for its violation.

When the fires ceased last June, Mr. L. S. Emmons, the Chief Firewarden, commenced immediately the prosecution of all persons who had burned their fallows between April first and June first as forbidden by law. Suits were commenced against each offender, irrespective of the fact that in many instances the fire did not escape from the owner's premises. The law was intended to stop

a dangerous practice; hence no distinction was made in this respect. Up to this date Mr. Emmons has obtained judgments in fifty-six cases, and has collected fines to the amount of \$1,781.45, not including costs, which in each case were paid by the defendant in addition to the penalty. The fines imposed ranged from twenty dollars to one hundred and seventy-five dollars, and in a few instances, where the defendant refused to pay, he was sent to jail. Several suits are awaiting trial, and other prosecutions will be commenced as soon as the necessary evidence is obtained. This work has kept the Chief Firewarden busy the entire summer. Also, several arrests were made by the town firewardens, which resulted in the conviction of the various defendants and the enforcement of a penalty in each case.

It may be reasonably expected that this vigorous, wholesale enforcement of the law will tend to decrease largely the number of fires from this source in the future. Anyway, there are fifty-six farmers who will not burn their fallows hereafter in the close season, and their neighbors have had a good opportunity this summer to learn what they also may expect in case they violate this section of the law.

Of the incendiaries arrested, three are now serving terms in State Prison for their offence. In some other prosecutions begun for this crime we were unable to obtain a conviction. Among the different causes reported by the wardens there are many attributed to fishermen, hunters, campers, etc. This may suggest that, as the firewardens knew the source of these fires, some arrests should have been made in connection with them. But these statements of the wardens were based upon their opinion in the matter, and not upon any positive facts or information. While they had every reason to believe that the fire originated as described, they could not obtain evidence of the definite character necessary to secure a conviction of the suspected parties. This will always be the case until we are authorized to employ patrols who can follow and watch fishermen, hunters, campers and other persons who would be liable to start fires while wandering through the woods.

The Forestry Law of the State of New York, so far as it relates to extinguishing fires, is a good one. It is admirably drawn, is well adapted to the various requirements which it is designed to meet, and it has been perfected by years of experience in its practical working. It has been used as a model by the forestry departments of other States, which have copied it, in the main, making only such modifications as their peculiar conditions or amount of appropriations made necessary. While its various sections enable the Commission to use all proper means for fighting forest fires, it does not contain sufficient provision for their

prevention. The best way to fight fires is to have no fires. Our present law works well enough in ordinary years, but it does not accomplish its purpose in a season of exceptional drought, and it fails to eliminate the danger from railroads. Unless amended in these respects it will be only a question of time before there will be a recurrence of a similar or worse disaster.

The patrol system may be expensive some years, but it will cost less than fighting fires that otherwise will surely occur, to say nothing of the loss of property and injury to forest conditions. It cost \$153,000 to fight fires this year, the most of which could have been prevented by the expenditure of a small proportion of this money in hiring patrols to guard the railroad lines and to watch the dangerous parties who were strolling through the woods. I doubt, however, if any law or force of patrols can prevent incendiary fires, for the men who commit these crimes in most instances select places and opportunities that enable them to avoid detection.

The patrols are needed only during a part of April and May, and in many years a rainy spring would render their services unnecessary. A summer drought may occur some year (as in 1899) when the firewardens would have to order them on duty to guard the forest. That portion of the expense incurred by patrolling railroad lines should be borne in part by the railroad companies, the proportion to be determined by the Legislature. But however this may be arranged, the patrols should be under the sole authority and control of the local firewardens. In other localities the expense should be borne by the town and State, as provided under the present law for fighting fire. If the railway managers would consent to the use of petroleum in April and May, and at such other times as the forest conditions might require, the number of men needed for this purpose would be greatly reduced. But petroleum is much more expensive than coal, and so the companies may prefer to employ patrols rather than make any change in their motive power.

This is no new idea. The system has already been in force for several years by the Canadian Government with good results. In 1902 there were 234 rangers employed on the Crown lands at an expense of \$34,200. This plan was put in operation in 1885, at which time thirty-seven men were employed on this duty. The result was so satisfactory that the number was increased from year to year, until now there are 234 men employed on this work. The great Algonquin Park, in the Province of Ontario, which has an area of 1,109,383 acres, is also watched carefully by forest guards whose principal duty is the prevention of fires. The Dominion Government has found that, in the administration of its own lands, the method of prevention is the cheapest in the end.

I here wish to call your attention to the important services rendered by Mr. L. S. Emmons, the Chief Firewarden of the Commission. During the fires last spring he was on the ground every day from first to last, assisting the wardens in organizing working parties, and, at times, superintending the men personally. When this work was finished he devoted his time to the prosecution of persons who had violated sections of the Fire Law, after which he returned to the Albany office, where he has been busily engaged in the adjustment of the accounts between the various towns and the State.

I also desire to acknowledge the valuable assistance received from Foresters Knechtel and Pettis, each of whom worked faithfully during the critical period of the fires. Through the energetic care and activity of Mr. Pettis the extensive plantation of seedling trees at Lake Clear Junction was saved from destruction. With a party of men he stopped a dangerous fire that burned its way to the edge of the plantation and extinguished it there before any loss was sustained, except on a small area of planted ground along the border. Forester Knechtel also rendered valuable assistance in the tabulation of the statistics in the 643 reports received from the firewardens; and in preparing for future reference a practical digest of other information, which also appears in these returns.

Annual Forest Product.

As customary in my previous reports, I also submit here, for your information, the yearly statement, showing the extent of the timber cutting in the Adirondack and Catskill forests and the amount of the product. The statistics given are for the year 1902, as the returns for the current year are never obtainable in time for my annual report.

A tabulation of the returns made to this office from each sawmill, pulp-mill, acid factory, cooperage plant and wood-consuming industry, drawing its supply of raw material from the Adirondack forest, shows the following output:

ADIRONDACK FOREST.		Feet B. M.
Spruce		148,859,311
Hemlock		60,177,715
Pine		40,218,643
Hardwood		34,851,571
Pulp-wood (461,806 cords)		253,531,494
Wood for chemicals, cooperage, etc.		34,383,870
Total		<u>572,022,604</u>

ADIRONDACK FOREST— (Concluded).

	Pieces.
Shingles	32,826,000
Lath	45,987,200
Total	78,813,200

This is the largest output of any year in the history of the State, and exceeds that of the previous year by 27,767,711 feet.

The sixth item includes 35,000 cords of wood cut by the Chateaugay Ore and Iron Company and used in their works at Lyon Mountain, Clinton County.

LUMBER COMPANIES USING THE LARGEST AMOUNT OF STOCK.

COMPANY.	Location.	Feet B. M.
Norwood Manufacturing Company	Tupper Lake	22,355,000
Finch, Pruyn and Company	Glens Falls	20,550,000
Beaver River Lumber Company	Castorland	12,900,000
Kenyon Lumber Company	Sandy Hill	12,753,260
Buck's Bridge Lumber Company	Canton	11,000,000
Moose River Lumber Company	McKeever	10,325,000
Sherman Lumber Company	Tupper Lake	10,052,035

INDUSTRIES CONSUMING THE LARGEST AMOUNT OF PULP-WOOD.

COMPANY.	Location.	Cords.
International Paper Company	Watertown	40,688
J. and J. Rogers Company	Ausable Forks	33,049
Hinckley Fibre Company	Hinckley	33,000
Union Bag and Paper Company	Ballston Spa	30,000
International Paper Company	Piercefield	28,292
International Paper Company	Cadyville	23,923
Dexter Paper Company	Dexter	18,000
International Paper Company	Glens Falls	17,515

These figures do not indicate the relative amount of business done by the pulp companies, as many of them get a large proportion of their stock from Canada, and hence some of the largest concerns do not appear in this list.

CATSKILL FOREST.

OUTPUT OF THIS REGION AND INDUSTRIES IN WHICH USED.

	Feet B. M.
Lumber (mostly hardwood)	58,618,352
Acid factories (92,099 cords)	50,562,361
Excelsior, pulp, etc. (17,333 cords)	9,515,817
Total	118,696,530

	Pieces.
Shingles	4,698,000
Lath	4,454,500
Total	9,152,500

LUMBER PRODUCT OF THE CATSKILL REGION BY COUNTIES.

	Feet B. M.
Delaware	26,770,858
Greene	6,205,794
Sullivan	17,218,840
Ulster	8,422,860
Total	58,618,352

SUMMARY.

	Feet B. M.
Adirondack forest	572,022,604
Catskill forest	118,696,530
Total	690,719,134

As the collection of the information relating to the annual forest product necessitated a correspondence with 655 different firms or individuals and the tabulation of the statistics thus obtained, it will be seen that no small amount of time and work were expended on this part of our office business. In some instances, where a firm or individual failed to make a return, a special journey to the mills of these parties was made in order to obtain the desired information.

The thanks of the Commission are due to the various persons engaged in these industries for their prompt and courteous replies to our request for a statement, their cooperation in this respect enabling us to ascertain definitely the facts

as to the extent of the annual output, a knowledge of which is so essential to a correct understanding of the forestry situation in our State. In the collection and tabulation of the statistics thus obtained I am indebted to the assistance of Mr. A. B. Strough of this office, his previous experience for several years on this same work enabling him to collate the figures with accuracy.

Forests as a Summer Resort.

The annual supply bill, passed by the Legislature of 1903, contained the following item:

"For the expense of collecting and publishing statistics and other information relating to amount of capital invested, number of persons employed, wages paid, and volume of business done at the summer resorts in the counties containing the Forest Preserve and public parks of the State, \$1,500, or so much thereof as is necessary."

It was further provided in the act that the work necessary in securing and publishing this information should be done by your Commission. During the summer a list was made of the 3,526 hotels and boarding-houses in the Adirondacks, Catskills and at the Thousand Islands. A circular-letter was mailed to each proprietor explaining the object of the Commission in thus addressing him, and with the circular was sent an information-blank, which he was asked to fill in with the desired statistics. The forms used for this purpose read as follows:

STATE OF NEW YORK.

FOREST, FISH AND GAME COMMISSION,

ALBANY, *October 1, 1903.*

DEWITT C. MIDDLETON, *Commissioner.*

J. DUNCAN LAWRENCE, *Deputy Commissioner.*

N. Y.

DEAR SIR.—We shall include in our annual report for 1903 some statistics showing the extent of summer-resort business carried on by the Northern hotels and boarding-houses, the total capital invested in buildings, the number of guests, number of employees, total wages paid, and gross receipts from all sources. As it is essential that these statistics should be based on statements furnished by the proprietors of the various hotels and boarding-houses, instead of on estimates made by others, a copy of the enclosed circular has been mailed to each.

The figures thus obtained will not be printed, but will be treated as a confidential communication. In no case will they be shown to any assessor, or used

in any way that might influence the assessment of property. The published statistics will contain no information as to any particular hotel or boarding-house, but will show only the total footings of the returns.

Will you kindly fill out the blank in the enclosed circular at your earliest convenience and remail it to us. In case you cannot readily refer to your accounts or hotel register, you are at liberty to fill out the answers from memory, or as near as you can.

The combined figures from the returns will show the volume of the Northern summer-resort business of New York, the large amount of money distributed there for wages, and the influence of this business on the development and prosperity of that region. This valuable and interesting information, together with a schedule of the summer hotels and boarding-houses, their proprietors, and the capacity of each place, will be printed in a special report, a copy of which will be mailed to your address.

Trusting that the interest you must feel in all information of the kind will prompt you to cooperate with us in this work, we remain,

Yours very truly,

FOREST, FISH AND GAME COMMISSION.

COPY OF INFORMATION-BLANK FURNISHED.

STATE OF NEW YORK.

SUMMER HOTELS AND BOARDING-HOUSES.

SEASON OF 1903.

Name of hotel or boarding-house.....
 Name of proprietor..... Postoffice address.....
 Railroad station..... Capacity.....
 Total number of guests, boarders, fishermen and hunters in 1903.....
 Number of guests that remained over two weeks.....
 Number of guests from outside of the State of New York.....
 Total capital invested in buildings, all kinds, and furniture, not including land, \$.....
 Total number of employees (clerks, cooks, porters, waiters, chambermaids, bell-boys, house mechanics, musicians, stablemen, drivers, house guides, etc.).....
 Total wages paid employees and help, male and female, \$.....
 Total receipts for board, laundry, carriage hire, boat hire, golf grounds, etc., \$.....

NOTE.—If your hotel is open all the year, please omit any figures for your winter or commercial business, but include tourists, pleasure and health seekers, fishermen and hunters.

As a general thing the replies were prompt and satisfactory. But many of the proprietors, fearing that the information might be used to their disadvantage by the town assessor, answered only in part and omitted the figures showing the value of their buildings or capital invested. This omission was unnecessary, as

the circular sent them stated plainly that their replies would be treated as a confidential communication. Still, some persons flatly refused to furnish this particular item, and so an official of the Commission, competent to make a fair estimate as to the value of this class of property, was sent to obtain the lacking information.

In some instances, where parties made a complete return, the value of the property was evidently an understatement, the owner having the assessors in mind when he filled out his report. On the other hand, some hotel proprietors, actuated by a feeling of rivalry or pride in their business, reported their yearly receipts at an amount beyond that which the extent of their buildings and accommodations would indicate. For these reasons the figures in the condensed statement may be regarded as approximate rather than strictly accurate.

The information compiled in the course of this work is too voluminous for insertion here, and hence it will be sent to the Legislature as a special report. I am able, however, to submit the following:

SUMMARY.

LOCALITY.	Total advertised capacity.	Total number of guests.	Guests remaining over two weeks.	Guests from outside of New York State.
Adirondacks	32,863	204,523	44,956	22,876
Catskills	89,978	224,382	89,732	44,866
Lake George	5,389	26,272	5,237	3,110
Thousand Islands	4,918	47,209	4,316	17,251
Total	133,148	502,386	144,241	88,103

LOCALITY.	Total capital invested (exclusive of land).	Total number of employees.	Total wages paid employees.	Total receipts.
Adirondacks	\$4,164,620	7,452	\$541,959	\$3,999,139
Catskills	11,131,200	17,986	539,580	4,443,848
Lake George	1,131,500	1,009	48,508	282,227
Thousand Islands	1,243,500	1,155	63,694	350,156
Total	\$17,670,820	27,602	*\$1,193,741	\$9,075,370

* Does not include board.

These figures show that our forests occupy a valuable place in the political economy of the State, aside from their product and the industries dependent on them. In addition to the sanitary benefits, the esthetic advantages, and the

maintenance of fish and game, they offer this peculiar source of wealth and further diversification of business. But it must be remembered that this desirable condition is solely dependent for its continuance on the preservation of the forests, which constitute the sole attraction to the thousands who throng these summer resorts. If the mountain slopes and upland plateaus of the Adirondack and Catskill regions are denuded of their forest cover—if in place of these sylvan attractions there is to be only a dreary waste of stump fields and fire-blackened areas—the thousands of summer visitors will seek other places, the hotels and boarding-houses will then be tenantless, and the people of the State will lose this source of revenue. The permanence of our forests will depend largely on the permanence of tenure; and there is no permanence of tenure aside from that of the State.

I append to this report some extracts from the firewardens' reports which you will find readable and interesting. They throw a sidelight on the situation and furnish certain items of information that are necessary to the obtaining of a full and correct idea as to events in the Adirondacks during the fires of 1903.

Trusting that the discussions in this report will meet with your approval, and that the suggestions may receive your favorable consideration, I am,

Yours very respectfully,

WILLIAM F. FOX,

Superintendent State Forests.

ALBANY, N. Y., *December 31, 1903.*

What the Firewardens Had to Say.

I append here some extracts from the reports of the town firewardens which furnish additional information of a special character and serve to give a better idea of the conditions under which their work was carried on. They are from practical, experienced men whose opinions are entitled to careful consideration. While I do not always agree with the firewardens in their views and suggestions, it seems proper to call the attention of the Commission to what they have to say about these matters. In these extracts from the "Remarks" in their reports, it is highly satisfactory to note the keen interest and zeal which they evidently take in the discharge of their duties. Nowhere have I found anything indicating apathy or indifference. I also include some extracts from letters and telegrams

received from them, which were sent in order to get instructions or advice as to doubtful questions that came up in the course of their work; also some from letters sent by citizens in relation to the fires in their towns or on their property:

MR. GEORGE W. MEADER, Dannemora, Clinton County.—We had a drought lasting sixty days. The land had been cut over and left with brush and some standing timber in small spots. I worked two days in putting out fire at the edge of a 600-acre tract of State land near Dannemora Prison, and stopped it before it did any damage. I have arrested five persons for building fallow fires without permission, and so have stopped any more setting of such fires.

MR. WILLIAM HOPKINS, Ausable Forks, Clinton County.—I do not think the fires this season were of incendiary origin. Never in my experience have conditions been so favorable for fire. For seven weeks not one drop of rain fell, and the drought began so early that vegetation did not get a chance to start. If it had, it would have retarded the fire materially.

MR. B. R. BREWSTER, Newman, Essex County.—This fire was the worst of all. A terrible wind arose on the third of June about twelve o'clock. The wind carried the sparks through the woods at a rapid rate. In the territory around the South Meadows and Adirondack Lodge about 6,000 acres had been lumbered. The Spruce and Balsam brush made good fuel, and the fire swept over an area of 10,000 acres in one afternoon. The timber burned was of little value, as it was all hardwood and too far from market.

MR. ROBERT H. WILSON, Olmstedville, Essex County.—This tract was lumbered last season, and all the large timber was cut off. There was quite a lot of small Spruce and Balsam left, which in time would have been valuable; but now everything is killed. There was so much brush to feed the flames that the fire burned very fast.

MR. WASHINGTON CHASE, Newcomb, Essex County.—This fire would have been very disastrous had it not been for the prompt action of a large force of men who stopped it and held it under control until rain came.

MR. WILLIAM H. BROUGHTON, Moriah, Essex County.—We could not put the fires out, but we kept them from running by leaving men to watch the ground after they were once under control.

MR. CHARLES GIDDINGS, Ausable Chasm, Essex County.—This fire was on Pine land that had been lumbered. The tops and brush left in the woods made a very hot fire; the young timber was mostly killed. This fire (May fourth) was on Trembleau Mountain. It did very little damage, for we kept it out of the valuable timber and held it at the top of the mountain where there was very little to burn. We fought it for three days against a strong south wind, then the wind shifted to the west and the fire was soon extinguished.

MR. C. W. ROWE, Chesterfield, Essex County.—The Delaware and Hudson Railroad has about ten miles of track in this town—nearly all of it along a mountain side, and with very few buildings in sight of the road. This mountain side was covered with forest when the railroad was built, but it has been burned over so many times since that nearly all the timber has been killed and is falling down, making excellent fuel for a forest fire. The law requiring railroad companies to pay all losses from fires caused by their engines has been utterly ignored. Not a dollar has ever been paid for damages, the company claiming that we must prove that their engines set the fires, and to prove this we must see the fire leave the engine and strike the ground. If the railroads cannot prevent these fires by putting proper appliances on their locomotives, then it is a serious problem. If they can do so and do not attend to it they should be prosecuted. The fires in this town are now under control, but the engines on the Delaware and Hudson Railroad set fires on the mountain south of Port Kent nearly every day. If the trainmen on this road make any effort to prevent them, such efforts are of no avail. Their fire screens are not worth a straw, and if the officials of the road don't know it, it is time they did. I venture to say that 100 fires have been set by engines on this road within sight of my residence, a distance of four or five miles.

MR. C. A. JORDAN, Elizabethtown, Essex County.—In regard to my estimate on the value of buildings destroyed, I would say that it was made up as follows: Euba Mills, \$2,000; house, barn and blacksmith shop, \$1,000; three tenant houses (\$500 each), \$1,500; one farmhouse, barn and outbuildings, \$1,500; total, \$6,000. No fences or bridges of any value were destroyed.

MR. JAMES WOOD, Schroon, Essex County,—I have been putting up posters. I find that I have a good many fallows to burn, if they don't burn them before they have a right to. The people claim that they can burn on their own land when they have a mind to, for the law is no good. If that is the case, I don't see any need of firewardens. But I gave them to understand that I should do my duty, and that I would report them. They said that I could not prove that they set the fire. I told them if the fire was there it was evidence that they started it or knew who did. I further told them that if they did not have a printed permit from me they were liable to a fine. I told them you had written me cranky letters and said for me to report them, and that you would put the law in force. They say you cannot unless the fire goes off their land. I told them it made no difference whether the fire got off their land or not; that they were liable to a fine just the same. I mean to do my duty as long as I am firewarden.

MR. CHARLES HOOPER, Westport, Essex County.—I spoke to the station agent at Westport about these railroad fires and he got quite mad about it. He said the railroad was blamed for everything. The agent admitted that he did not think there was anything to prevent the sparks from escaping. Most of the damage is done by freight trains.

MR. GEORGE H. MCKINNEY, Ellenburg, Franklin County.—The fire did not run much until a high wind drove it over a large area. On April thirtieth the wind blew again very hard, and it was then that nearly the whole tract of 500 acres was burned over. The Spruce had been mostly cut off, leaving only hardwoods. The fire ran in the Spruce tops left in the woods. I could not get men enough to stop it, as the wind was blowing so hard and the timber was so dry. The fire was checked the next day (May first) by the weather becoming cold.

MR. B. L. REYNOLDS, Reynoldston, Franklin County.—The district burned over was mostly brush and wild lands. It was not very valuable, but it was quite near to buildings, and work was principally directed to protecting these. It is almost impossible to extinguish fires completely now. The best one can do is to be sure it is out all around the edge far enough so that it will not throw sparks. But to put out absolutely all old logs, stumps, etc., all over the tract, would take a whole pond of water. This fire (June ninth) came from the adjoining town of Dickinson, and could be controlled only on the virgin forest land. It was held there by continual work until rain came.

MR. BENJAMIN A. MUNCIL, Paul Smith's, Franklin County.—I had miles of ditches dug.

MR. FREMONT F. SMITH, Loon Lake, Franklin County.—The timber on some of these burned lots is falling down. I think something should be done in regard to the donkey engines they are using on the new road which they are building. They have burned the whole country up now, and they are going to run up to the outlet of Loon Lake with them in a few days. We cannot keep men enough over there to keep the fire out, as they start flames wherever they go. I don't think they are using any screens at all.

MR. PERKINS SMITH, St. Regis Falls, Franklin County.—I went over the burned area (300 acres) and found that it was entirely virgin forest, heavily timbered with White Pine. But I think this Pine will not die for two or three years yet. The hardwood had been cut before this fire occurred, but a large amount of pulp timber was standing which was badly damaged. Shall I allow men pay for fighting fire on their own lands? The point in question is this: The agent for O. P. Dexter has worked his men in connection with other men warned out to fight fire on Dexter's land.

MR. A. N. SKIFF, Onchiota, Franklin County.—There were times when the men were away in other places fighting fire, and so I got the women out to help. If I hadn't done so nothing could have stopped the fire from burning every building for miles around here. The women fought two nights, all night long, and waded brooks clear to their knees. I say they fought fire better than the men, they were that scared, and were more thorough in putting it out than the men were. I kept their time the same as the men and made out their account and swore to it, and then the town firewarden would not allow them anything for it. The

board said they ought to have it as well as the men, but he wouldn't allow it. When Henry Paye was firewarden he had to get the women out in some places, and he allowed them the same as the men, for he said they fought better. Up in the town of Brighton they had women fighting fire and they got their pay the same as the men. There are lots of times when the fires are raging so bad that every one has to turn out. I am going to send this account to you and see if you don't think they ought to have their pay. I say it is a shame if they don't, and I think you will pay the same.*

MR. EDWARD M. SMITH, Saranac Lake, Franklin County.—I think the railroad company should put more men on the track in a dry time.

MR. WILLIAM J. BELLIN, Fulton County.—The fire is still burning in the ground at places. It cannot be extinguished now, as there is no water. I am watching it all the time so that it will not spread.

MR. NETUS LANCASTER, Stratford, Fulton County.—The fire is burning into the muck very deep.

MR. F. W. ABRAMS, Piseco, Hamilton County.—I can see how a camp might have prevented this fire. There is no camp on this lake (Sand Lake), and this is the second time that a fire has occurred here. A fire for cooking is built in the woods, and a high wind arising, sparks are blown into the forest, starting a fire that soon gets beyond control. I have had no fires where there were camps for people to use.

MR. R. B. NICHOLS, Indian Lake, Hamilton County.—We kept the fire from running except on the day when the wind blew so hard. Then it got the advantage of us, but as soon as the wind went down we surrounded it again. I have the fires under control and nearly all out at this time (May second). No great damage has been done, as the fires ran mostly in the leaves and did not burn very deep; but over in Minerva, Essex County, on Township 15, it burned pretty hard. I think perhaps it would be well for you to come here after the fires are over, as we will have to do some business with some of those fellows for burning fallows; also with some that would not go to the fires when ordered out to do so by the district wardens.

MR. WELLINGTON KENWELL, Inlet, Hamilton County.—All of the men turned in and carried water. At night three of them carried water and had the fire all out by morning. Then three men connected a pipe line, turning a one and one half inch stream of water on the burning ground. We kept this pipe line running for three weeks. One fire started opposite the mouth of Indian River, just about the Beecher Camp. I think it was started by a smoker, as there were parties fishing there. The fire on Lime Kiln Lake was started by parties camping there. I employed a man to get the names of the sportsmen who were seen there

*The women were paid.—W. F. F.

the day before the fire was discovered. This case seems easy of proof. Smokers start most of the fires in this locality. A match thrown down, or a pipe knocked out, will start a fire in a few minutes.

MR. BYRON AMES, Nehasane, Hamilton County.—The origin of this fire will always be a mystery. There appears to be no reason to suspect malicious intent; and there is small probability that it was due to carelessness. It started near an old stump where some bottles and tin cans had been thrown from camp buildings unoccupied for many months. Some claim that the rays of the sun acting on the bottoms of the old bottles were brought to a focus, the same as when passed through a sunglass. Another theory is that the fire caught from flying embers blown from other fires. This is a very plausible theory, because for days the air had been full of sparks, and of the millions falling some few must have carried fire. Only the day before (May nineteenth) the men at work there found a small fire spreading on the surface of a path or road in some old sawdust and they extinguished it. They could not account for its origin. Mr. Conklin, a log jobber, within four or five miles of this point, about this time found two fires in the woods, the origin of which he could not account for. It is very probable that they caught from wind-dropped embers. The Chief Firewarden of the State and the warden of the town of Long Lake were at this fire. They approved of the course pursued in handling it, and no unfavorable criticism was made to me either during or after the fire. The situation was a trying and desperate one, and the wonder is that the destruction was not greater.

MR. W. D. JENNINGS, Long Lake, Hamilton County.—I sent District Firewarden Michael McManus to the fire. He claims that it was the same one which had been burning in the muck, and that the wind blew it up. We supposed it was entirely extinguished. I sent to Newcomb for help, and by June first we had 125 men on the line back-firing and trenching.

MR. MARTIN BOH, Morehouseville, Hamilton County.—This would have been a very serious fire but for the promptness of Theodore C. Remonda, district firewarden, to whom great credit is due for reaching the place with men and teams as soon as it was possible to do so. By sundown we had it under control, so that on the next day we wholly extinguished it.

MR. FRANK STANYON, Wells, Hamilton County.—I am sorry to say we have got three fires in this town, but they have not done much damage yet, as they are burning on land that has been burned over before. It is covered mostly with briars, brakes and dead timber. Perhaps you are aware that it is hard to put out fire in such a place as that when it is so dry as it is now, and we have quite a wind every day, which makes it bad. I am doing my best to stop it with as few men as possible. It is not yet near any valuable timber. It is the opinion of some of our citizens that these fires are started to make feed for Deer.

MR. J. H. HIGBY, Big Moose, Herkimer County.—We have a bad fire at Sisters Ponds, in Township 41. I put on about sixty men yesterday and some thirty more last night. The belt is about half a mile wide by one mile long, but it is burning like a furnace. The smoke and heat are intense, but we have held it on the west and south. I have got another tough proposition. The men say that I have no right to order them to go into Hamilton County to fight fire. If you will do so, please send me a written order that I may show them. That is not all: there is a lot of men that refuse to go, not knowing where the pay is to come from. You know there is no provision for the pay before next winter. You see, I am handicapped all around. I am sending in seven men that I will pay myself, and the other hotels are sending in some men also. These floating chaps demand their pay at once, but I am unable to advance the money. Mr. Parsons, the town firewarden, cannot send in men because he has a bad fire down at Old Forge.* I have no idea how the fire started, nor can I find out anything about it. I have now sixty men on the ground night and day. We are doing all we can and will save every rod of timber possible. I go around the fire line myself and direct the men where the work is needed most. I was not on the ground this morning, but I put my son in charge in my absence. He was up day before yesterday, night before last, and all day yesterday, without sleep or rest. The men have worked in heat and smoke. I think I can handle affairs now. I have taken up blankets and put in boats, tools and provisions. I haven't weighed out anything as yet because my time has been so much taken up. But I will make an offer to board the men at four dollars per week to save the bother of weighing out provisions. Now, another thing: how many hours is a day's work? The men say eight hours. I don't know what you think about it, but I am keeping the time by the hour.

MR. J. E. ROBERTS, Old Forge, Herkimer County.—The fire at Fulton Chain is not the same as when you were here. Another one caught near the railroad and is burning on the east side of the track below Fulton Chain, but I have it under control. I have sixty men at the Big Moose fire, and have notified the warden in Long Lake, as it is outside of this town by three miles. The fire at Beaver River is burning slowly, but Bullock is doing good work and keeping it from spreading. It is so far through the woods to the fire on Watson's East Triangle that I have asked Miller to take care of it from the town of Croghan. A new fire started on the land of the Adirondack League Club, caused by a camp fire. It burned fiercely, but to-night I have it down in good shape. Mr. De Camp is very anxious to

*This letter was received the same day that the Governor placed funds at the disposal of the Commission. The Superintendent notified Mr. Higby to hire all the men necessary to extinguish this fire, which was on State land and was running in the direction of the Raquette Lake Township. The State has 100,000 acres of virgin forest land in a solid block where this fire occurred, but it was completely extinguished before it burned a very large area. The fire was in Hamilton County and there were no residents within several miles, except a few who were in a lumber camp near Big Moose Lake. It could be fought only by sending men in from Herkimer County, as the firewarden at Long Lake, the town in which it occurred, lived thirty-six miles away.—W. F. F.

know what can be done in regard to raising money, but I tell him I don't see as anything can be done at present. He has paid his men, upon my orders on bills, about \$1,000, and he does not want to wait until the town audits the bills for his pay. I wish you would see him in regard to the matter. Many of the fires are greatly exaggerated by people who tell what they hear but who do not go near the fires at all. They say the fires burn over more land than they actually do. A report was made to-day of 1,000 acres when it did not exceed 250 acres that were burned.

MR. RILEY PARSONS, Old Forge, Herkimer County.—The way I have done so far is to give the men a regular voucher okayed by me and have them paid by the individuals upon whose land the fire occurred. The latter can turn these vouchers over with the duplicate to the town board when they audit accounts, and I will see that they correspond to the abstract sheet which I keep of them.

MR. DUANE NORTON, Brantingham, Lewis County.—We take our tents with us and stay right at the fire line. I tell you we don't lose much ground where we drive our stakes. I have been at work along the Lewis County line and have not been driven back more than half a mile at any time. Mr. Marvin admitted that he set his fallow* on fire Thursday, the seventh. The district firewarden discovered it, and calling out all the available men stopped it in the face of a heavy wind. An hour's delay and it would have been beyond control. He did excellent work and at the right time. We paid our men two dollars per day and board, as we had to keep them in camps and tents along our fire line. Our town board, at my request, came together and borrowed \$500, and I got two other parties to advance as much more. So, you see, our men knew they would get their pay as soon as they were through. I tell you I could do as much with that class of men as could be done with a trainload of city men. We took none but thorough woodsmen.

MR. D. D. GRAHAM, Harrisville, Lewis County.—The air was so full of smoke that we could not see a fresh fire when it started. The whole country seemed to be on fire at once.

MR. CHARLES CORBETT, Osceola, Lewis County.—I went to the fire as soon as I could, on the fourteenth, and got help from the sawmills and three men—a clerk in a store, a minister and a farmer. These three men do not want any pay. This fire (May fourth) was on the farm of Adelbert Kinney. He lost thirty cords of stovewood and all of his pasture. The pasture was an old slash that had been burned over and sown to grass seed.

MR. EUGENE HATHAWAY, Diana, Lewis County.—The situation here is bad. We have been on the fire line since April twenty-eighth with no signs of a let up. It is hard for me to get help enough to take care of the fires; we have to employ

* This man was arrested and fined for burning a fallow in the close season.—W. F. F.



A. KNECHTEL, PHOTO.

FIRE UNDER CONTROL.

MEN DIGGING TRENCHES TO PREVENT IT FROM SPREADING.



K. GOLDTHWAITE, PHOTO.

PLOWING FURROWS TO STOP PROGRESS OF A GROUND FIRE.



all the men we can get, and the most of them are poor men, with families, who must have their pay as fast as they can earn it. I have to find some man that will buy their account so they can have their money to live on. Any help you can give me at this time will be greatly appreciated.

MR. STEPHEN WALDRON, Chase's Lake, Lewis County.—In reply to your telegram I beg to say that I am at work, with about eighty men, and am doing all that can be done. The supervisor and members of the town board are also at work with me.

MR. JOHN A. LEYNDECKER, Croghan, Lewis County.—Mr. Hecker has shown me the telegram you sent him in regard to the fire. Miller and Parsons have not sent me any help as yet, but I have sent some men across the Herkimer County line to fight the fire in Watson's East Triangle. The fire here burns through the mucky land from twelve to fifteen inches deep, and therefore we have to dig trenches for miles on both sides of it. We are digging them three feet wide, and have thus far done fine work since your telegram to Mr. Hecker.

MR. G. V. NORTON, Chase's Lake, Lewis County.—Fires will sweep the forests if the towns will not pay men honest wages in the future. Men will not work without pay. All they paid men for labor in our towns was one dollar and fifty cents per day, and a man must board himself at that price. Kindly write me what to do about the board bill, as I have waited all summer now.

MR. WARNER YEOMANS, Forestport, Oneida County.—This was a hard fire to extinguish because it was burning in the muck. When it was apparently all out, and no smoke could be seen, a high wind would fan it into life and cause it to break out again. Please send me two dozen blank reports as soon as possible. I have been very busy driving from one fire to another organizing squads of men. The fires have been in different parts of the town at once; when I would go to one fire I could see another one in a different direction. I would organize squads to fight one fire and then start for another. All of my district wardens were just as busy. I cannot report exactly the number of days each warden and his men served at each separate fire, as they were on from two to four different ones the same day, and back and forth. Will get it as near as I can and will give you the accurate amount. This has been a very lively time in this town. Each warden and myself have done our best to quench and prevent fires.

MR. R. R. PRICHARD, Remsen, Oneida County.—In answer to your telegram and the complaint that was made to you that I neglected to do my duty as fire-warden in this town, I will say that I have done everything that could be done to stop the fire, and it was done in good shape. I had men out working at all points where there was danger. I went myself with five men to work at —— place and got the fire under control. But Mr. —— had seven or eight men working on his barn and he, by spells, put them to work in the woods to put out

fire, and sometimes doing other work. He called out lots of men to come to help him. He wanted me to say that I called them out so that they would get paid from the town and State. I refused to do that. I told him that I would not lie for him or for any other man, and that is the reason why he makes the complaint. I wish you would write to any officer in this town and ask him about my work as firewarden. I will do what is right with all persons, but I will not lie for any man, and I know that you don't ask me to do it. Please let me know if there is anything wrong and I will correct it.

MR. A. C. HICKOK, Corinth, Saratoga County.—The fire started about eight miles west of South Corinth. It was reported to me at a time when the air was very smoky; ashes and burned leaves were falling thickly. Everybody was frightened and supposed the woods all around us were burning up. I telephoned District Warden Eggleston to start at three o'clock the next morning, with all the men he could get, and look for fire. He was busy nearly all night ordering out his men. The next day he traveled over a large territory, but finding only this one fire, which was soon extinguished, he concluded that the smoky condition was due to fires outside of the town.

MR. HORACE WEBB, Edwards, St. Lawrence County.—There were springs and small streams in the woods from which the men carried water. They also dug ditches, where practicable, and used dirt to cover and smother the fire. Men were kept constantly on the watch, and yet it would spread to some extent, usually during the afternoon.

MR. EDGAR REED, Degrasse, St. Lawrence County.—The men fought fire until midnight, some of them without any supper.

MR. J. F. EVANS, Fine, St. Lawrence County.—The past week has been the worst time for fires that I have seen in years. The entire woods in the west half of this town, and, in fact, clear to Cranberry Lake, are on fire. The New York Central Railroad started seven fires on one run last week from Carthage to Oswegatchie. This fire is burning from the line of the railroad and Bear Lake clear through the woods. I have had out nearly seventy men at times.

MR. EMERY P. GALE, Piercefield, St. Lawrence County.—Have you any funds on hand to pay these men? There should be some way provided to pay men for fighting fire. These poor men have to live by day labor, and it is hard to make them wait until the following winter for their money.

MR. ARTHUR FLANDERS, Hopkinton, St. Lawrence County.—I came out of the woods on Friday night (May thirtieth) for the first time to get a day off since May eighth. I wish you would come here if you can, as there are about 4,000 acres burned over, mostly lumbered land. There is very little timber land burned. When you telephoned me from South Colton to meet you on Sunday I did not get the word until afternoon. I was seven miles away in the woods fighting fire, and

was short of help. Must I get the number of acres and the timber land burned over? If so, it will take me a month to do it. Will report again as soon as I feel it is safe to call all the men off.

MR. WILLIAM W. CHENEY, Caldwell, Warren County.—The grade from Lake George south to near the point of this fire is very heavy. There is also quite a heavy grade from the south to near this same point, and when trains pass up these grades a large number of live coals are thrown out from the smokestacks of the engines.

MR. MILES FROST, Thurman, Warren County.—I would have written you before now, but since the death of our firewarden, Mr. W. J. Fuller, I have been trying to ascertain whom we could appoint in his place. I think we had better appoint one Henry Combs. He is a young man and has always lived here. I think it is best for me to see the deputy wardens in Districts Nos. 2 and 3 this spring and have a talk with them, as they are young men and I would like to consult with them. The firebugs you speak of are now in jail. A boy caught them setting a fire, and there was a bill found against both of them, the leader on two indictments—one for shooting at the boy who caught him, and the other for setting a fire. These fellows have set a great many fires in our town.

MR. E. H. STURTEVANT, Fort Ann, Washington County.—Mr. Charles De Golver, a justice of the peace, was called on by the owner of Lot 24 at one o'clock Wednesday night. He got the men out early the next morning and did a good job, for the people were frightened almost out of their wits on account of the drought, heat, smoke and desperate fires. These men say that they had rather lose their pay than have to lose a day and travel thirty miles to get their bills sworn to. They are the best lot of men I ever saw to climb mountains and fight fires. But some of them say they will answer no more calls to fight fire. They are all poor men and cannot afford to lose their time and have so much trouble to get their pay. The deputy wardens claim they cannot get help for the price, which is one dollar per day, as fixed by the town board.

MR. ROBERT STEVES, Whitehall, Washington County.—At the commencement of the fire we had hard work to get men to fight it, as the town board had voted to pay only one dollar per day. Later, when the supervisors instructed me to pay a fair price for the work, the fire had gained such headway that the district warden had difficulty to manage it even with a large gang of men. When the fire reached the village limits the hose company was called upon by those endangered, and I would like to have you instruct me who will settle the claim.

MR. JOHN D. GRAHAM, Putnam Station, Washington County.—I wish you would call the attention of the officials of the Delaware and Hudson Railroad Company to the danger of fires which are being set by their locomotives nearly every day in this town, and to the fact of the insufficient work being done by their trackmen in putting fires out when they do occur.

MR. C. W. ROWE, Chesterfield, Essex County.—These fires were set by engines on the Delaware and Hudson Railroad. Fires are started every day, and I have to keep men watching all the time. Engines Nos. 55, 71, 113, 139 and 388 have been known to set fires, and we are willing to swear to it.

CATSKILL COUNTIES.

MR. GEORGE A. ELLER, Callicoon, Delaware County.—We worked until midnight, and could stand it no longer on the mountain without food and water, so we retired for the night and started again at daybreak, when we succeeded in putting the fire out.

MR. THOMAS S. MILLER, Andes, Delaware County.—The fire is supposed to have been started by William Van Kuren. He told different stories about it; one was that he was smoking out a hedgehog; another, that he lit a cigarette and dropped a match.

MR. THOMAS FORD, Shavertown, Delaware County.—A back-fire was set, though forbidden by the district firewarden. In my opinion the fire from this cause burned over 100 acres more than it would have done otherwise.

MR. M. W. KNIGHT, Hancock, Delaware County.—This fire occurred on the line of the Ontario and Western Railroad, and the work-train coming along with its gang extinguished it, so I had no men to pay. The other fire started in a fallow and spread to State land. There is quite a lot of Hemlock timber burned on the State land, and it ought to be cut and peeled this year in order to save it. In another year it will all be spoiled.

MR. E. A. HOWES, Trout Creek, Delaware County.—This fire had to be watched. It was extinguished several times, but as it was a very dry time it would start up after we thought it was entirely out.

MR. JEREMIAH E. HAINES, Haines Falls, Greene County.—The fire was so far from where men could be obtained to fight it that it was necessary to employ teams to carry the men back and forth. The dead Spruce branches made a fierce blaze, and one that was hard to fight and control.

MR. W. B. HALL, Cairo, Greene County.—I shall either appoint a new warden in his place or a deputy, as you suggest. He is a good, practical man, but on account of rheumatism he is unable to climb mountains. I have given plenty of warning to certain careless people, and they had better look out this summer. I think it about time that they realize that the State is not doing this for fun.

MR. PLYMOUTH DAVIS, Livingston Manor, Sullivan County.—I have had the following notice inserted in the newspaper: "On account of the great number of forest fires, I wish to inform farmers and taxpayers in general that it is to their

interest to see that the law relating to setting forest fires is fully observed. After June tenth fallows may be burned, and farmers may burn same by applying to the firewarden of their town and obtaining permit. From September first to November tenth no person will be allowed to burn any fallow or brush heap, and they should arrange accordingly. I earnestly request all taxpayers to inform me of any person who starts a fire, and to see that no fires are started on their own property. By so doing they will greatly lessen their taxes and at the same time contribute to the safety of our forests."

MR. J. W. DARBEE, Roscoe, Sullivan County.—Thunder and lightning began, and looking over on the mountain I saw a fire about the size of a barrel. It burned rapidly, but the rain stopped it from running. Three men, about a mile distant from one another, claim to have seen the lightning strike a stub where I noticed this fire.

MR. M. O. SERGEANT, Eldred, Sullivan County.—The town board has fixed the price for fighting fire at one dollar per day. There is a number of men here who say they will not fight fire if ordered out, claiming it is unconstitutional to force a man to work for so small a sum. What will be my duty in case they refuse to go when ordered out? I do not anticipate any trouble unless fire should break out on lands of some individuals who are very strict in regard to trespasses. Is this town obliged to pay those men for putting out fires inside Mr. Chapin's enclosure, men who also get their pay from Mr. Chapin? The park consists of several thousand acres, only a small portion of which is in this town. It is fenced with barbed wire to the height of ten feet, and any man found on his grounds, inside or outside, is prosecuted. His men shoot every dog that comes within gunshot, so you can see why there are so many fires near his park. Of course, the sympathy of all honest men is with Mr. Chapin.

MR. PHILIP GERHARDT, Fremont, Sullivan County.—On examination I found that a party of hunters had passed through the woods and immediately thereafter the fire was discovered. The fire was undoubtedly started by them. I wish to further state that I warned out one Charles Stosser, who refused to go. This has a bad effect on others, and I would recommend that something be done in his case.

MR. JAY H. SIMPSON, Phoenicia, Ulster County.—Fire started, in Broadstreet Hollow, May first. The wind was blowing fifty miles an hour, and the fire swept towards Phoenicia. I warned out men. Fought the fire all night Friday, Saturday and Saturday night and Sunday, and held it from coming into Shandaken. Walter Evans (firewarden) held it on the other side. We ditched and back-fired. In places the wind would carry the fire 300 feet over our lines.

What the People Had to Say.

MR. HARVEY J. DE SILVA, a citizen of Grant Mills, Delaware County.—I have a brier patch which I want to burn over. It is contiguous to my woodlands, with a front of only ten rods. I apply for permission to do so, providing you will permit me to inform our district firewarden, Mr. Everett Butler, to be present at my expense. The forest is in full leaf now, and I am sure that by diligent effort this proposed fire can be controlled. I do not wish to disobey our laws, and therefore make this request of you.*

MR. REUBEN LAWRENCE, custodian of the John Brown Farm, North Elba, Essex County.—Please come here at once. The firewarden, Mr. Byron Brewster, was here this morning and said he would like to have a private talk with you right away. He wants you to see the condition the fires are in near the John Brown Farm and other State lands. The men are doing all they can to keep it from the house. The fire is under control now, but I cannot tell how long it will stay so if the wind comes up. We are living in hopes that God will send rain in a short time to help the poor men that are trying to keep the fire down. All the men in this town are tired out and sick and exhausted. Still they will have to work. The firewarden is doing all he can.

MR. FRED CLEMENS, Lassellsville, Fulton County.—The origin of that fire was a peculiar one, and I would be pleased to have the board pass upon it. It was set by school children whom the teacher sent into the woods to gather flowers. A teacher whom the State helps to pay I should consider the first cause; therefore I believe the State is responsible to a certain extent for the damage done. This person whom the State has sent out as a proper one to manage children has caused me this great damage, and I think the State ought to help me bear the loss.

MR. WILLIAM S. DE CAMP, Fulton Chain, Herkimer County.—I telegraphed Mr. Emmons and you yesterday under the spur of a raging fire. I addressed myself also to Firewarden Parsons, who replied that he "thought he had done pretty well for me." He gave me the following authority in writing: "In my capacity as firewarden I hereby deputize you to hire and pay men to extinguish the fires." I proceeded to engage men upon the strength of the above. I have good evidence that the railroad, up to last Saturday, continued to use defective engines through this district, thereby continuing to set fires. Roberts, the district firewarden, has just now telephoned me in reply to a request for help that he "cannot be everywhere." I address this note to Colonel Fox in particular, as I am personally acquainted with him and am in communication with him on this matter by telegraph; also knowing that he will connect up with the proper authorities.

* Permission was refused.—W. F. F.

MR. EUGENE M. HOUSE, Big Moose, Herkimer County.—There is due me twenty-three dollars for fighting fire on State land in Township 41. I was left there on duty after all the other men had gone out of the woods. I agreed to pay twenty dollars to any man who would find fire there after I left. This was not a political job like tending a bridge or canal lock, where a man would not do enough for healthy exercise, but good, solid, hard work with axe and shovel. I think I have waited long enough. Please send check by return mail.

MRS. ELLA FLAGG, Saranac Lake, Franklin County.—I would like to call your attention to Messrs. Stratton & Lundstrom, contractors, engaged on construction work along the Saranac and Lake Placid Railroad, in regard to their engines setting fires. This morning the engine named "Grace" set a fire and ruined our private park. It would have burned our cottage only for myself and daughter fighting fire until the fire department arrived. The fire department of this place said that not one engine had a screen. One of the engineers told me that he had put on the screens to-day. They are setting forest fires from this place to Lake Placid.*

MR. CHESTER W. CHAPIN, President New England Railroad Company, 511 Bullitt Building, Philadelphia, Pa.—They are making it very hot for me up in Sullivan County. As soon as the wind blows towards my woods in goes the fire. The scamps have made the boast that they would burn me, and they are doing their best. The elements are in their favor, for we cannot get a drop of rain. I wish some of the rascals could be caught, for they must have injured 6,000 or more acres of mine already, and they have injured others even more. I am keeping a sharp watch, having plenty of men, horses and wagons, with water barrels and pails. These same fellows that fire the woods violate other laws. I would like to work with the Commission to help catch them.

MR. W. K. BENEDICT, New York City.—I was a passenger on the New York Central train from Saranac Lake to New York last Saturday night, and happening to stand in the rear vestibule of the last car of the train saw what I consider a good demonstration of how most of the fires that have been devastating the Adirondack forests recently are started. At very frequent intervals the tracks in the rear of the train were strewn with live coals, dumped from the locomotive, and in many instances these coals, dropping on the wooden ties, burned into bright flames, which only required a slight breeze to spread to the side of the tracks and to the forest. After seeing the miles upon miles of blackened ruin, caused by the recent fires, this struck me as a piece of wanton carelessness on the part of the railroad company that calls for investigation by the authorities, and it should be stopped at once if we care to save what remains of our fast disappearing Adirondack forests.

* These are the small locomotives employed by the contractors on the construction of the new line; the contractors are in the employ of the Delaware and Hudson Railroad. The engines are the ones referred to in my report.—W. F. F.

"PLATTSBURG SENTINEL," May 29, 1903.—On Wednesday, while a man named Sancombe was driving along the road between Hunter's Home and Goldsmith's, his horse was struck by a falling tree, which had burned off near the bottom, and was instantly killed.

"TICONDEROGA SENTINEL," May 7, 1903.—A farmer's boy near Everton went to the pasture after a horse, and both boy and horse were burned to death.

"EVENING JOURNAL," Glens Falls, June 9, 1903.—Yesterday, at Indian Lake, some cattle were turned out in a swamp which had been burned over, but which was apparently free from fire by reason of the recent rains. However, the cattle sank into the soft earth and fire burst forth in several places, seriously burning the animals.

"TROY RECORD," June 4, 1903.—A dispatch from Plattsburg says that at Cadyville the woods were all afire near the village. The Catholic Cemetery was burned over, and a large force of men finally succeeded in saving the Catholic Church. At Twin Pond, on the Chateaugay Railroad, a wooden trestle took fire from the forest fires, and a freight engine broke through, carrying Engineer Kelly down with it. He escaped, however, with slight bruises.

"ESSEX COUNTY REPUBLICAN," May 29, 1903.—George McDonald's camps near Tupper Lake were destroyed. Mrs. Joseph Prevost had given birth to a child only a few hours before. She was carried on a mattress to the railway, where she was placed on a hand-car and removed from danger. Members of her rescuing party were severely burned. A woman was left in one of the camps through some mistake, and when this was discovered George McDonald and Chester Carr ran through the flames and rescued her. They found her on her knees praying, and, strange to say, this camp did not burn, although another, a short distance away and seemingly in much less danger, was destroyed.

The loss of life in all of these fires, if any, was small. There were reports from time to time of persons who were burned to death, but thus far I have been unable to verify these rumors.

While I was at the Fulton Chain fire there was a story afloat that two of the Italians belonging to a large gang sent in by the New York Central had lost their way, or been cut off by the flames, and were burned to death. I cannot learn, however, that their bodies were found, as would probably have been the case if this accident had happened. The *Utica Herald* of June fifth states that William Howe, of Lake Placid, was shut in by the flames, while fighting fire near the foot of Mt. Marcy, and smothered to death by smoke. I have been told since that this was a mistake. In view of the thousands of men who were at work under extremely dangerous conditions it is a matter of congratulation that there was no greater loss of life.

W. F. F.

The Wild Animals.

NUMBER OF DEER TAKEN DURING THE SEASON—CONDITION OF THE ELK AND MOOSE—BLACK BEAR AND BEAVER.

It will be a matter of satisfaction to all sportsmen to know that the statistics show a steady increase in the number of Deer in the State forests. No better argument can be advanced in favor of the present system of protection, and it is believed that local interests are steadily becoming convinced that the laws as they exist are for the good of all concerned. The eagerness with which information is sought as to the success of the hunters annually is an evidence of the widespread interest that is taken in these returns, affecting, as they do, a very large number of those who derive a considerable portion of their income from the sportsmen who seek a few weeks recreation in the forest, as well as from the transportation lines whose business is materially increased by the hunting season.

Adirondack Deer.

From the statistics furnished by the American and the National Express Companies the following figures, showing the shipments of Deer, have been compiled:

Year.	Carcasses.	Saddles.	Heads.
1900	1,020	89	95
1901	1,062	103	121
1902	1,354	113	193
1903	1,961	145	188

The percentage of increase in the shipments, which last season was about thirty per cent, is seen this season to be more than forty-four per cent over that of the previous year. Following the apparently reasonable rule that for each Deer shipped out at least four others are killed in the woods, it can be readily seen how greatly they have increased under our present laws.

According to the carefully compiled figures of the shipments furnished by Mr. John L. Van Valkenburgh, Superintendent of the American Express Company, and Mr. T. N. Smith, Superintendent of the National Express Company, the number of Deer sent out of the Adirondacks by hunters during the season just closed was shown to be as follows:

SHIPMENTS OF DEER FROM POINTS IN THE ADIRONDACK REGION.

SEASON OF 1903.

MOHAWK AND MALONE RAILROAD.

RAILROAD STATION.	Carcasses.	Saddles.	Heads.
Beaver River	234	7	11
Big Moose	58	7	.
Bog Lake	5	.	.
Brandreths	1	2	3
Childwold	10	2	.
Clear Water	106	1	2
Eagle Bay	6	.	1
Floodwood	4	1	.
Forestport	44	6	4
Fulton Chain	82	6	.
Horseshoe	1	.	.
Lake Clear	10	2	.
Lake Kushaqua	4	.	.
Lake Placid . . . . .	.	.	5
Little Rapids	1	.	.
Long Lake	81	1	2
Loon Lake	10	2	.
McKeever	24	.	3
Mountain View	4	.	1
Onekio	3	.	.
Onchiota	1	.	.
Otter Lake	14	.	.
Owls Head	8	.	.
Paul Smith's	17	4	9
Piercefield	55	5	5
Pleasant Lake	4	.	.
Poland	35	1	.
Rainbow Lake	6	.	.
Raquette Lake	30	4	.
Saranac Inn	2	4	2
Saranac Lake	6	.	.
Tupper Lake Junction	82	1	1
White Lake Corners	12	.	.
Woods Lake	25	2	2
Total	985	58	51

NEW YORK AND OTTAWA RAILROAD.

RAILROAD STATION.	Carcasses.	Saddles.	Heads.
Brandon	6		
Derrick	65		4
Kildare	7		
Madawaska	2		
Minnehaha	10		
Santa Clara	34		2
Spring Cove	10		2
St. Regis Falls	7		12
Tupper Lake	7		13
Total	148		33

UTICA AND BLACK RIVER RAILROAD.

Alder Creek	9		
Aldrich	9		
Benson Mines	36	4	
Boonville	7		
Carthage	3		1
Castorland	16		
Glenfield	44	2	4
Harrisville	37	6	
Jayville	18		1
Lowville	24	2	
Lyon Falls	12		1
Natural Bridge	1	1	
Newton Falls	40		1
North Croghan	1		
Oswegatchie	25	1	1
Port Leyden	13		
Prospect	54	4	
Total	349	20	9

FONDA, JOHNSTOWN AND GLOVERSVILLE RAILROAD.

Cranberry Creek	1		
Gloversville	13	1	
Johnstown	2	1	1
Northville	118	19	24
Total	134	21	25

ROME, WATERTOWN AND OGDENSBURG RAILROAD.

RAILROAD STATION.	Carcasses.	Saddles.	Heads.
Antwerp	3		
Canton	5	3	
De Kalb Junction	1		
Edwards	7	1	1
Massena	1		
Philadelphia	1		
Potsdam	24	5	
Watertown	3		
Total	45	9	1

LITTLE FALLS AND DOLGEVILLE RAILROAD.

Dolgeville	17	1	
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NEW YORK CENTRAL AND HUDSON RIVER RAILROAD.

Fonda	5	1	
Little Falls	4		
Total	9	1	

RUTLAND RAILROAD.

Bangor	2		
Knapps	1		
Malone	3		15
Winthrop	4		1
Total	10		16

CRANBERRY LAKE RAILROAD.

Wanakena	61	6	12
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DELAWARE AND HUDSON RAILROAD.

Bloomingdale			1
Caldwell	1		2
Crown Point	1		1
Hadley	1	1	
Keeseville			3
Loon Lake	1		1

DELAWARE AND HUDSON RAILROAD — (*Concluded*).

RAILROAD STATION.	Carcasses.	Saddles.	Heads.
Lyon Mountain	1	. . . . .	1
North Creek	127	27	5
Port Henry	14	. . . . .	2
Riverside	10	1	8
Saranac Lake	4	. . . . .	. . . . .
Stony Creek	37	. . . . .	1
Ticonderoga	4	. . . . .	5
Westport	2	. . . . .	11
Total	203	29	41

RECAPITULATION.

Mohawk and Malone Railroad	985	58	51
New York and Ontario Railroad	148	. . . . .	33
Utica and Black River Railroad	349	20	9
Rome, Watertown and Ogdensburg Railroad	45	9	1
Fonda, Johnstown and Gloversville Railroad	134	21	25
Little Falls and Dolgeville Railroad	17	1	. . . . .
New York Central and Hudson River Railroad	9	1	. . . . .
Rutland Railroad	10	. . . . .	16
Cranberry Lake Railroad	61	6	12
Delaware and Hudson Railroad	203	29	41
Total shipments	1,961	145	188

Some of the larger Deer mentioned in the shipping receipts indicate a growth that is highly gratifying. Among the shipments were these:

SOME NOTABLE SHIPMENTS.

RAILROAD STATION.	Consigned to—	Dressed weight (pounds).
Clear Water	F. S. Smith, Auburn	200
Fulton Chain	J. McGuire, Utica	200
Long Lake West	H. Walters, New York	200
Loon Lake	M. Keefer, Utica	200
Loon Lake	Charles Keaton, Rosendale	250
Owls Head	Kate Butrick, Malone	200
Owls Head	E. W. Savage, Moira	250
Piercefield	W. McKim, Saranac Lake	210

SOME NOTABLE SHIPMENTS — (*Concluded*).

RAILROAD STATION.	Consigned to —	Dressed weight (pounds).
Potsdam	J. F. Kelley, New York	203
Benson Mines	W. Richardson, Canton	200
Harrisville	R. Harding, Syracuse	207
Newton Falls	W. Heims, Oakfield	200
Newton Falls	H. Mathews, Syracuse	200
Oswegatchie	E. W. Eissig, New York	200
Port Leyden	F. Price, Great Bend	200
Prospect	J. W. Seator, Utica	200
Prospect	Arthur Martell, Utica	200
Derrick	John Kimball, Utica	200
Derrick	W. M. Bell, Long Lake West	200
Derrick	C. Naylake, Tupper Lake Junction	210
Derrick	W. Jarvis, Big Moose	210
Santa Clara	E. Walsh, New York	220
Northville	J. Bartholomew, Amsterdam	210
Northville	John Kreed, New York	237
Northville	J. Kinnear, Albany	200
Northville	R. M. Evans, Johnstown	210
Northville	B. D. Smith, Johnstown	200
Northville	J. H. Kaston, Fonda	200
Northville	F. S. Dunn, Albany	200
Northville	E. Shannon, Amsterdam	200
Northville	H. Brownell, Amsterdam	205
Onekio	F. M. Jackson, McKeever	250

In addition to these interesting figures, a correspondent of *Forest and Stream*, on November twenty-first, mentions several large Deer, within his knowledge, as having been shot. His list included a 230-pound ten-pronged buck, shot near Minnehaha, by George Benton, of Utica; a 250-pound buck, shot at Horn Lake, by Seth W. Pride, of Holland Patent; a 250-pound seven-pronged buck, shot near Star Lake, by Schuyler S. Bardlong, of Chicago; a 250-pound buck, shot near Boonville, by Captain William Connor, of New York; a 250-pound buck, shot by J. F. Dorrance, of Camden, and a 247-pound buck, having fifteen prongs, shot near Alpine, by Edward Floyd. The last weight given is specifically mentioned as being dressed weight. A number of other Deer shipped out by the express companies weighed over 200 pounds, but unfortunately the names and addresses of the successful hunters were not given.

Mr. Wesley D. Jordan, of Saranac Lake, shot the only Albino, or White, Deer reported during the season. It was killed near Raquette Falls, and will be mounted for exhibition.

It is a matter of satisfaction to be able to note that very few casualties were reported this year in connection with the Deer season. The number of minor accidents was inconsiderable, and the number of fatalities so small as to warrant the belief that the warnings of previous years have had a salutary effect.

The Elk and the Moose.

The effort to restore Elk and Moose to the Adirondack forest, which was begun by the State two years ago, with the cooperation of a number of public-spirited citizens, continues to be a subject of much interest to the people. The restoration of the Elk, thanks to the continued generosity of Hon. W. C. Whitney and others, has progressed so rapidly since the first consignment of twenty-two was liberated at Raquette Lake, in June, 1901, as to have passed almost beyond the experimental stage. During the year just closed seventy-three Elk were liberated at various points in the woods, the work being superintended by Mr. Paul Smith, the veteran hotel proprietor; Dr. F. E. Kendall, of Saranac Lake, and Mr. Ernest H. Johnson, the superintendent of Mr. Whitney's Adirondack estate. These Elk were all contributed by Mr. Whitney.

The total number of Elk which have thus far been liberated in the Adirondacks is one hundred and forty. The number of young which have been born in this region during the past two years has been approximated at fifty. Of this total of one hundred and ninety Elk, four have been accidentally killed by trains and eight are known to have been shot. Allowance should also be made for perhaps ten deaths, through natural causes, since June, 1901. There would thus remain at large in the Adirondacks one hundred and sixty-eight Elk, which estimate probably represents very closely the actual number in the Adirondacks to-day. When first liberated the Elk seemed disinclined to roam far from the immediate locality in which they had been set free, and for months they could be seen grouped together within a few miles of the spot where they had first been liberated at almost any time. But as the young were born and the animals became more accustomed to their surroundings, the herds began to split up into families of three or four and to move off into the deeper forest in every direction until, within the past few months, their presence has been reported in seven out of the ten Adirondack counties. Wherever they have been seen they have caused much admiring com-

ment on the part of summer tourists, many of whom have found great pleasure in photographing the animals. It is probable that, as the young Elk gradually take the place of the older ones, these animals will again become as truly a wild denizen of the Adirondacks as naturalists tell us they were in the past.

Without a continuation of the appropriation which lapsed last year nothing further can be done toward restocking the Adirondack region with Moose. Thus far the animals liberated have done well and have scattered widely through the forest. Three have been shot by unknown persons, and no natural increase has thus far been reported. If the experiment is to be continued, it will be necessary, in the opinion of those who have given attention to the problem, to procure and liberate at least fifty, or preferably one hundred, more of these animals in the Adirondacks. The Commission stands ready to carry out the instructions of the Legislature in the matter, and undoubtedly that body will respond to the public sentiment which makes itself apparent.

The Black Bear.

The Commission has previously recommended and again suggests the passage of an act giving to the Black Bear of the State some measure of protection. The trend of modern sportsmanship is toward the pursuit of large game, as is shown by the great number of hunters who annually visit Canada, the Rocky Mountains and the Southwest, and who even cross the ocean to hunt still larger and more savage game. Could the Black Bear of this State, an animal absolutely harmless to human life, yet affording the keenest sport to its pursuers, enjoy for a few years the protection of a close season it would be possible to introduce Bear hunting as a feature of Adirondack life, even as it is now carried on as a profitable sport in many parts of the West and South. The Commission recommends that, as the Bear is commercially valueless during the summer months, his pursuit be prohibited at this season of the year, and that suitable regulations be provided as to trapping.

The Beaver.

This most interesting of North American fur-bearing animals, which formerly existed so abundantly in this State, is on the brink of extinction within our borders. "No animal," says Dr. C. Hart Merriam, "has figured more prominently in the affairs of any nation than has the Beaver in the early history of the new



H.T. S. WATSON

A HIGH ONE.

world. Its influence on the exploration, colonization and settlement of this country was very great. The trade in its peltries proved a source of competition and strife not only among the local merchants but also between the several colonies, disputes over the boundaries having frequently arisen from this cause alone. Indeed, on more than one occasion jealousy of the Beaver trade led to serious difficulties in the struggles for supremacy between the three rival powers, the Dutch, English and French."

How great the number of wild Beavers in this State once was may be inferred from the statement of the Dutch author quoted by Dr. Merriam, who, writing in 1671, states that at that time the colony of New Netherlands furnished "80,000 Beavers a year." As late as the year 1815 we learn from De Kay that the Beaver still existed in such plentiful numbers in the Adirondack region that it was possible for a party of St. Regis Indians, who that year ascended the Oswegatchie River, in St. Lawrence County, for the purpose of pursuing these valuable animals, to return after an absence of a few weeks with three hundred Beaver skins. In 1895 Mr. Wilbur C. Witherstine, of Herkimer, shot a Beaver in the outlet of Madawaska Pond. About the same time two Beavers were caught by trappers from Saranac Lake. These are, as far as known, the last wild Beavers to have been taken in this State. The following winter the Legislature passed a law absolutely prohibiting their pursuit under a severe penalty.

While the Beaver to-day is practically extinct in the State, there are known to exist one or two small families in the Adirondacks. Mr. Harry V. Radford, the New York sportsman, to whose energy and persistency is chiefly due the inauguration by the State of the experiment of restoring Moose and Elk to its forests, and who also has been one of the most interested in the plan to secure protection for the Black Bear, is in possession of a number of interesting specimens of Beaver work. These consist of fresh wood cuttings—sections of small Aspen trees which have been peeled of their bark by the Beavers, and in which their tooth-marks can be plainly seen. The specimens were collected recently in the Adirondacks. The Commission is of the opinion that, as the Adirondack region is a natural Beaver country, and as the Beaver multiplies rapidly, a small appropriation is desirable to procure several colonies of these interesting and valuable animals for the purpose of eventually restoring them to the woods.

The Fish Hatcheries.

WORK OF THE YEAR—SUGGESTIONS FOR IMPROVING THE PLANT AND INCREASING THE OUTPUT.

In reporting the work of the State's hatchery system for the year, the Commission calls particular attention to the fact that the returns from this branch of the business intrusted to its care are far above any outlay. During the year which ended on September 30, 1903, there were distributed among the waters of the State 140,982,805 fish of various varieties. (In 1902 the total distribution was 128,672,516.) With the exception of 1,750 fish which were saved from the wide-waters of the canal when it was emptied for the winter, these fish were all reared in the State hatcheries.

Owing to the interest taken in the work by the railroads of the State, the entire output of the hatcheries was distributed to the people without expense for transportation, messenger service or other cost of delivery, which, in the case of commercial hatcheries, is figured at about fifty per cent of the value of each shipment. The market value of the total output of fish, at the lowest prices charged by hatcheries which sell their product, exclusive of the cost of delivery, was \$108,069.02.

The number of applications received for fish during the year was 1,908 (in 1902 it was 1,459), and there were carried over from the previous year 395, making a total of 2,303 applications to be filled. The number actually filled was 1,551, and 240 were rejected for various reasons, making a total of 1,791 applications which were acted on. Owing to the fact that the State fish car "Adirondack" was badly damaged in a railroad accident while the season was at its height, the work of distributing the fish from the hatcheries was considerably retarded, although the railroad officials kindly provided every facility possible to push the work. Notwithstanding this interruption, however, but 512 applications were carried over, as compared with 527 carried over in 1902.

Of the total number of fish distributed 136,518,850 were of the various varieties of food-fish, and 4,463,955 were of the varieties known as game-fish. Of the game-fish over thirty-three per cent were of the size called "fingerlings," and over ten per cent were yearling fish. The Commission has made it a rule not to distribute yearling fish unless the waters stocked are closed for a period of at least two years. The demand for fingerlings is steadily increasing, and in order to keep up with it some few improvements will be necessary at several of the hatcheries.

The demand for Black Bass also continues, for which reason the suggestion made a year ago, as to the desirability of providing suitable rearing ponds, is repeated. Other improvements necessary at the several hatcheries are indicated in the abstracts of the reports of the hatchery foremen, which are appended.

Advices received from various parts of the State show that the work of the Commission in stocking inland waters is thoroughly appreciated by commercial fishermen and the sportsmen. In fact, it would not be a difficult matter to demonstrate to the average citizen that the fish planted in the waters of the State form a valuable asset in every community. Game fishermen annually spend many thousands of dollars in the localities in which they seek their favorite sport, and a fair livelihood is earned by thousands of men who pursue the business of fishing for the markets. Without the continual replenishing of the State waters with fish from the hatcheries to meet the demands of our steadily increasing population there would be but little sport and much less income in a very short time.

Approximately, what the work of the Commission means in this connection may best be judged from the figures which show the commercial value of the fisheries of the State in an average year. These figures, which are authenticated by the United States Commission, are as follows:

Value of the Hudson River fisheries	\$150,000 00
Fisheries of inland lakes and streams	80,000 00
Lake Erie, Lake Ontario and the Niagara and St. Lawrence Rivers	250,000 00
The coastal fisheries	3,700,000 00

These figures are given in round numbers and the totals do not vary to any great extent from one year to another, the tendency being toward an increase rather than a decrease, as will be apparent from the fact that the actual commercial value of the fisheries of the inland waters during the year 1902 was \$87,897 instead of \$80,000, as given, which sum represented 1,530,918 pounds of fish of all kinds. Further argument would not seem necessary to show how highly important is this portion of the Commission's work, which, statistics show, has been one of steady progress along the lines indicated ever since the Legislature created the first Fisheries Commission, thirty-five years ago.

A very attractive and satisfactory exhibit was made at the State Fair at Syracuse, where permanent aquaria have been constructed for this purpose. The

great interest taken in this inexpensive display of the work done at the hatcheries was apparent to every visitor, and the exhibit received many favorable comments. The fish, with the exception of the Albino Trout, were turned over as usual to the Anglers' Association of Onondaga County for distribution in near-by waters.

Acknowledgment is made of the receipt of 1,830,896 Lake Trout eggs from the United States Fisheries Commission, which were forwarded to the Caledonia Hatchery on November 9, 1902.

The Commission has abandoned the Sacandaga Hatchery for the reasons given in last year's report. This hatchery was located twenty-two miles from the railroad station and could only be reached over a rough mountain road. Experience showed that it could not be successfully operated, and improvements made at the Adirondack Hatchery, which is easily accessible, will make it possible for this hatchery to do all the work.

Following are tables showing in detail the distribution for the year and the work done by each hatchery:

FISH DISTRIBUTION.

SUMMARY FOR YEAR ENDING SEPTEMBER 30, 1903.

Brook Trout fry	1,395,000
Brook Trout fingerlings	761,300
Brook Trout yearlings	130,840
Brown Trout fry	670,000
Brown Trout fingerlings	179,000
Brown Trout yearlings	55,500
Grayling Trout fry	180,000
Lake Trout fry	184,000
Lake Trout Fingerlings	443,400
Lake Trout yearlings	250,275
Rainbow Trout fry	32,000
Rainbow Trout fingerlings	130,000
Rainbow Trout yearlings	48,100
Redthroat Trout fingerlings	1,000
Landlocked Salmon	2,040
Frostfish	3,055,000
Maskalonge	4,107,600
Pike-Perch	69,080,000
Shad	1,250,000
Smelt	5,160,000
Shrimp	50,000

SUMMARY FOR YEAR ENDING SEPTEMBER 30, 1903 — (*Concluded*).

Tomcods	34,700,000
Whitefish	19,116,000
Total	140,981,055
Saved from canal	1,750
Grand total	140,982,805

RECORD OF EACH HATCHERY DURING YEAR 1903.

ADIRONDACK HATCHERY.

Brook Trout fry	190,000
Brook Trout fingerlings	373,000
Brook Trout yearlings	15,000
Lake Trout fry	85,000
Lake Trout fingerlings	71,000
Rainbow Trout fingerlings	61,000
Redthroat Trout fingerlings	1,000
Frostfish	260,000
Whitefish	2,500,000
Total	3,556,000

CALEDONIA HATCHERY.

Brook Trout fry	305,000
Brook Trout fingerlings	47,500
Brook Trout yearlings	35,340
Brown Trout fry	395,000
Brown Trout fingerlings	26,000
Brown Trout yearlings	25,000
Lake Trout fry	50,000
Lake Trout fingerlings	324,400
Lake Trout yearlings	201,775
Rainbow Trout fingerlings	37,000
Rainbow Trout yearlings	33,600
Landlocked Salmon fingerlings	2,040
Pike-Perch	8,500,000
Whitefish	6,000,000
Shrimp	50,000
Total	16,032,655

NINTH REPORT OF THE

CHAUTAUQUA HATCHERY.

Maskalonge	4,107,600
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COLD SPRING HATCHERY.

Brook Trout fry	400,000
Brook Trout fingerlings	197,300
Brook Trout yearlings	32,500
Brown Trout fry	10,000
Lake Trout fry	49,000
Lake Trout fingerlings	1,000
Rainbow Trout fry	12,000
Pike-Perch	300,000
Shad	1,250,000
Smelt	5,160,000
Tomcods	34,700,000
Whitefish	250,000
Total	42,361,800

DELAWARE HATCHERY.

Brook Trout fry	95,000
Brook Trout fingerlings	45,500
Brook Trout yearlings	39,000
Brown Trout fry	100,000
Brown Trout fingerlings	72,000
Total	351,500

FULTON CHAIN HATCHERY.

Brook Trout fry	260,000
Grayling Trout fry	180,000
Rainbow Trout fry	20,000
Frostfish	2,795,000
Total	3,255,000

ONEIDA HATCHERY.

Pike-Perch	60,280,000
Whitefish	10,366,000
Total	70,646,000

PLEASANT VALLEY HATCHERY.

Brook Trout fry	145,000
Brook Trout fingerlings	98,000
Brook Trout yearlings	9,000
Brown Trout fry	165,000
Brown Trout fingerlings	81,000
Brown Trout yearlings	30,500
Lake Trout fingerlings	47,000
Lake Trout yearlings	48,500
Rainbow Trout fingerlings	32,000
Rainbow Trout yearlings	14,500
Total	670,500
Grand total output	140,981,055



Report of the Chief Game Protector

1903

To the Forest, Fish and Game Commission:

GENTLEMEN.—In accordance with your instructions I hereby submit a report of the business of my Department for the year ending on September 30, 1903. It shows the work performed by the force of protectors in the bringing of actions, the amount of recoveries in fines and penalties, and the time served in jail by several persons; the number and value of nets and other devices for the taking of fish which, while being used in violation of law, were seized and destroyed; the amount received for the sale of the timber confiscated from trespassers who had been lumbering on State land, and the sale of old abandoned buildings, together with a summary of the licensed nets operated by commercial fishermen, with the fees received; the amount and value of the fish caught during the year, and other matters of interest.

Much credit is due the Legislature for the valuable amendments, passed at the last session, which secured more uniform laws; the abolition of spring Duck shooting; the prohibition of the sale of Woodcock and Grouse taken in this State, and the sale of Trout in certain counties, which last should, in the opinion of many, apply to the entire State.

In speaking of the excellent legislation secured, I believe I am expressing the sentiment of the Commission in saying that the Department is under great obligation to the New York State Fish, Game and Forest League for the valuable assistance rendered in educating the general public up to the necessity for the enactment of better laws.

The Value of Protection.

From answers to letters sent to nearly every county in the State, my personal observation, and conversations had with well-informed persons, I feel warranted in reporting that there is more interest being manifested each year in the protec-

tion of the forests, fish and game, and the artificial propagation of fish and game. All admit that but for the work of the hatcheries the inland waters would have been depleted of fish and the St. Lawrence River of the Maskalonge, which is also true to a great extent of the Shad of the Hudson River and the Whitefish of Lakes Erie and Ontario.

Too much cannot be said by the residents along the St. Lawrence River in praise of the work done in stocking that river in past years with Maskalonge from the Chautauqua Hatchery. The fish are becoming quite plentiful, and large catches have been made in the past two years as against a very few prior to artificial stocking. The fish are a great attraction to tourists who visit the Thousand Islands, and are also profitable to the residents along the river.

The reports from the Catskills and Adirondacks show that the Deer inhabiting those localities have increased one hundred per cent since the anti-hounding law went into effect. Deer can now be found also in a number of the counties that are not classed in the Adirondacks or Catskills—as, for instance, in Columbia, Rensselaer, Saratoga, Schenectady, Montgomery, Oswego and the western portions of Lewis and Oneida Counties, where but a few years ago none were to be found. This proves beyond any doubt that the law which prohibited the use of dogs in the hunting of Deer is the cause of the increase, and it is to be hoped that this law will not be repealed to please a very few who are agitating for it.

Condition of Birds.

The reports from various localities where Pheasants have been liberated are very gratifying. As a rule, the residents are using every means to assist in protecting them, and are looking forward every spring to securing an additional supply from the State.

Quail are becoming quite scarce, except in Suffolk County, where a fresh supply is liberated every spring by private clubs, and I believe that a small appropriation should be made for the purchasing of live Quail. They are a hardy bird, and there is no reason why they should not be propagated by the State and again become plentiful.

Grouse suffered severely, in the spring of 1902, from the continuous cold and heavy rainstorms, which drowned many broods of young birds. They also suffered to some extent in localities that were swept by forest fires in the early summer of 1903, but as the fires were confined largely to the Adirondacks, and as Grouse are not as plentiful in the deep forests as in the second-growth timber,

the loss was not as great as it otherwise would have been. But in view of the law passed in the winter of 1902-03, which prohibits the sale of Grouse that are taken in this State, which law was very generally observed during the past open season, there is every reason to believe that Grouse will again become plentiful in the Adirondack region.

No little dissatisfaction is being manifested in regard to the private parks and preserves that have been created in localities where the State has planted millions of fish for the benefit of the public. The park owners are waging war on the natives as well as on the tourists, who both feel that their rights are being trampled upon, and that the park owner has no more property interests in fish that migrate from one water to another than has the general public who contribute towards maintaining the State hatcheries.

The Wild Animals.

With reference to the Elk that have been liberated in the Adirondacks since the summer of 1901, I can say that they have done extremely well, and, in fact, much better than was expected by those who expressed an opinion relative to the matter. The first shipment, comprising twenty-two Elk, donated the State by Hon. William C. Whitney in 1901, that were liberated in the vicinity of Raquette Lake, went through the first winter without any loss and came out in fine condition the next spring, much to the surprise of every one, and several calves were found with them in the early summer, showing that they were breeding fully as well as the Adirondack Deer.

The three carloads of Elk that were donated by Mr. Whitney in the fall of 1902, forty of which were liberated in the vicinity of Little Tupper Lake and twenty at Raquette Lake, wintered equally as well as those the previous winter, and the seventy-three liberated during the past summer near Paul Smith's, Saranac Inn and Saranac Lake, except a few that have been killed by cars, have done well and are now reported as having gone back into the deep forest, where they should have been liberated instead of turning them loose near the settlement and railroad.

It is safe to say that there are now 180 Elk in the Adirondacks, not including many that escaped from Mr. Webb's park by reason of a fire having destroyed the fences, or those that have escaped from time to time from Mr. Litchfield's preserves near Big Tupper Lake.

Condition of the Law.

I would not recommend any extensive revision of the game laws, now that they appear to be in very good shape. Some minor changes as to phraseology and to make plainer a few sections are, however, needed. One relating to Jamaica Bay and adjacent waters, where the use of nets is prohibited, is especially necessary for the benefit of the numerous anglers who visit that locality and who cannot fish with safety outside in the ocean. The law relative to the licensing of nets, especially in the Great Lakes, should be changed, as the license fee is now practically nothing. This is not the case in other States bordering on Lake Erie, particularly in Pennsylvania, where the State derives a large revenue from these licenses, and where they charge according to the tonnage of the boat. The license law was first advocated for the protection of residents of New York State, but fishermen from Ohio and Pennsylvania evade the law by coming into this State, registering their boats and giving a bill of sale (in some instances) to residents of this State, who apply for a license, which may cover a gang of gill nets one mile long, at a cost of only one dollar.

The size of the mesh of nets, especially in Lake Erie, should be increased to at least a one and one half inch bar as against the present mesh of one and one eighth inches. This is advocated by the fishermen themselves, who claim that myriads of small fish that are of no value are caught and killed in the gill-nets, which must tend to lessen the fish supply.

If possible, something should be done to induce the Legislature of Vermont to pass uniform laws with this State governing the fishing on Lake Champlain, which is interstate water, and in which the residents of this State are much interested. Our own laws absolutely prohibit the use of nets, but their last Legislature, instead of repealing a law which allows the use of nets in the lake, as had been promised, not only failed to do so, but passed a law which allows the taking of Black Bass in the lake during the entire year as against a close season in this State from January first to June fifteenth. As there is but an imaginary line between the two States, it is difficult to enforce the laws of this State on the lake. It might be possible for the Legislature to appoint a commission to act with a commission from Vermont to agree upon some uniform law and give each State concurrent jurisdiction over the lake, as was done in the eighties by this State and Pennsylvania over the Delaware River where it divides the two States.

I would also recommend a law that would prohibit the killing of Deer between one half hour after sundown and one half hour before sunrise, as the law relative to the use of artificial lights cannot well be enforced with the improved methods now in use in the operation of an electric jacklight, with a storage battery, which it is difficult to detect.

The figures obtained from the express companies show that the number of Deer transported during the fall of 1903 is a trifle in excess of that of 1902, which might be expected from the large increase in Deer and the increase yearly in the number of hunters. But as Deer seemed plentiful at the close of the hunting season, and as reports show that there are plenty of Deer signs now in the woods, there does not seem to be any necessity of a change in the law in the way of shortening the season, although three months and a half, as the law now provides, seems a long time in which Deer can be taken. Possibly, if the season did not open until September fifteenth instead of the first, it would be better, as Deer are not at their best and fawns are not sufficiently grown to be deprived of their mothers.

The usual facts about the Deer and other Adirondack animals will be found elsewhere in this report.

Salaries of Protectors.

I must continue to advocate an increase in the salaries and expense accounts of the protectors. A salary of \$500 is not a fair recognition for the services of a competent official, and an expense account of \$350 is inadequate. An increase of \$100 per year, making a salary of \$600, and \$50 added to the expense account, making \$400, would only require an additional appropriation of \$6,750, and would be something of an encouragement, besides giving the protectors to understand that their services were being recognized, and, in the course of time, will be more fully appreciated and an effort made to compensate them adequately for the hazardous work they have to perform.

The twelve protectors added to the force by the laws of 1902, who were appointed at the beginning of the present fiscal year, have added materially to the efficiency of the Department. These protectors have been able to cover much more territory than could have been properly guarded by a lesser number, and have secured results which clearly demonstrate the wisdom of the Legislature in making the increase.

Actions and Recoveries.

The following statement will show the number of actions brought and the amount of recoveries in fines and penalties, which does not include numerous actions now pending against persons for trespassing on State land and for the recovery of lands where adverse title is claimed, and does not also include several actions now pending in the Supreme Court, the Appellate Division and the Court of Appeals for the taking and possession of game in close season, some of which have obtained no little notoriety:

SUMMARY OF RECOVERIES.

	Fines and penalties.	Trespass fines.
Regular protectors	\$10,971 47	\$4,640 98
Special protectors	1,691 75	110 50
Firewardens	1,335 90	
	\$14,049 12	\$4,751 48
Total fines and penalties		14,049 12
Grand total		\$18,800 60

As a result of the actions brought three hundred and seventy-seven persons were fined, twenty-seven were acquitted, twenty-two were sent to jail for nine hundred and twenty-one days, one was held for the grand jury, eleven had suspended sentences, six cases are pending, one was a nonsuit, in one the jury disagreed, and in one the suit was withdrawn; total, four hundred and forty-seven.

SUMMARY OF ACTIONS.

	Fines and penalty actions.	Trespass actions.
Regular protectors	293	41
Special protectors	71	8
Firewardens	34	
	398	49
Total fines and penalty actions		398
Grand total		447

STATEMENT OF TIMBER SOLD.

October 8	R. B. Poole	\$10 00
November 25	J. E. Leavitt	20 00
May 27	C. W. Pratt	4,335 00
August 8	E. Burhans	75 00
September 2	B. H. McCollom	32 50
	Old building sold	15 00
Total . . . . .	. . . . .	\$4,487 50

I wish to assure the numerous fish and game protective associations throughout the State that the assistance they render the local protectors, which directly benefits the work of the Department, is ever appreciated.

In conclusion permit me to extend my most sincere thanks for the cordial support received at your hands in sustaining every effort put forth by me and by the protectors in the enforcement of the laws.

Respectfully submitted.

J. WARREN POND,
Chief Game Protector.



Report of the Superintendent of Shellfisheries

1903

To the Forest, Fish and Game Commission:

GENTLEMEN.—I have the honor to present the following report of the business of the Shellfish Department, which, under the supervision of the Commission, has been assigned to my management as Superintendent of Shellfisheries. There are now held by the shellfish planters, under lease and franchise from the State, 27,871 acres for cultivation.

The lands leased during the past year are located under the waters of Long Island Sound, Raritan Bay, Jamaica Bay, Princes Bay, Great Kills and Lower New York Bay.

For the purpose of insuring accurate surveys of these lands coast signals, or monuments, are established and maintained along the shores of the bodies of water mentioned. Each tract leased and surveyed is carefully platted upon the maps and described upon the records of the Shellfish Office. These maps and records are of great and permanent value to the shellfish industry, as upon them depend the titles to all the lands held for shellfish cultivation in State waters.

Twenty-nine applications for grounds in Pelham Bay, East Chester Bay and adjacent waters have been received. As these waters constitute new territory for leases, it will be necessary to make a triangular survey for the purpose of erecting signals by which the tracts may be located.

Cold Spring Harbor.

No finer oysters are to be had than those which are taken from the waters of Cold Spring Harbor. Planters in those waters have for many years received their leases from the town of Huntington upon the assumption that the title to the harbor was, under an ancient grant, vested in the town. During the year the title of the town has been questioned and several applications for such

shellfish lands have been presented at this office. These applications have not been filed and advertised (the usual course), but are held in abeyance until an authoritative opinion, determining the matter of jurisdiction, may be had. The question is now under consideration by the Attorney-General, as will appear by his letter of November 9, 1903, as follows:

STATE OF NEW YORK,
ATTORNEY-GENERAL'S OFFICE.

ALBANY, *November 9, 1903.*

MR. B. FRANK WOOD, *Superintendent of Shellfisheries:*

DEAR SIR.—I beg that you will pardon my delay in acknowledging receipt of your letter of September eleventh, requesting my opinion as to whether your department has jurisdiction to lease lands under water of Cold Spring Harbor for shellfish cultivation.

The question you ask my opinion on is one intimately connected with the applications of Walter Jennings and others for grants of land under water of Cold Spring Harbor, in which the first hearing before the Standing Committee of Remonstrances of the Commissioners of the Land Office (of which I am a member) was held on the fifth instant. The several parties to these applications were given a reasonable time to submit briefs. Upon consideration of the various questions involved in these proceedings the question you ask will also be looked into, when I will be pleased to answer your question.

Respectfully yours,

JOHN CUNNEEN,
Attorney-General.

Should it be decided that the jurisdiction for the purpose of shellfish cultivation in those waters is in the State, it will be necessary, as in the cases already mentioned, to erect monuments for the purpose of a triangulation survey.

In the year 1884 a United States Coast Survey signal, known as "Ludlum 2," stood upon the northerly bluff of Center Island. This bank or bluff was gradually being worn away, and as the signal was of importance to our State oyster survey the Commission, in 1888, placed a new signal point exactly ten meters in a southerly direction from "Ludlum 2" and in a line with "Roosevelt's Windmill," known as "Ludlum 3." The bank has since caved away, carrying with it the United States signal. The monument over "Ludlum 3" had also disappeared when, this past fall, the Surveyor of Oyster Lands, under the direction of your Superintendent, undertook the relocation of this necessary signal. After many measurements he succeeded in finding the "point," which consisted of a bottle with a brass nail through the center of the cork, buried two and a half feet

under the ground. As this point was upon the lawn of property now owned by Mrs. Le Roy Dresser, this Department utilized, for the purpose of marking the spot, a flagpole which has long been in possession of the Commission.

This pole constitutes an admirable monument ("Ludlum 3") which can be seen in different directions and for a considerable distance over the water. The pole was firmly and permanently set in a stone and cement foundation. Then Mr. Wyeth, Surveyor of Oyster Lands, by means of mensuration and plumb, located down the bank the proper position of the United States signal ("Ludlum 2") and there drove down a piece of iron pipe six feet in length, so preserving this United States Government point.

State Control.

The better conditions of the shellfish industry and the increased production under State control was shown by your Superintendent in his report for the year 1901, published in the Seventh Report, from which I quote as follows:

From comparatively small beginnings the urgent necessities of the rapidly expanding industry of shellfish cultivation led, a few years ago, to the adoption by the State of a system of control of lands under the public waters suitable for the business; a system which includes a unification of laws; an elaborate plan of surveys, based upon the triangulations of the United States Coast Survey; the establishment of numerous intermediate coast signals and the preparation of necessary and carefully prepared maps and charts, together with grants of leases and franchises under well-defined boundaries. Thus has the older plan of control by localities, so palpably inadequate, been outgrown.

The obsolete local plan contemplated a right to the farmer or citizen, whose lands happened to be adjacent to or near a bay or sound, to take possession of a small piece of land under water, in size ranging from the fractional part of an acre to three acres, upon which he might dredge or rake a few bushels of shellfish for domestic consumption, or upon which the bayman owning a small boat could dredge the natural-growth oysters for the market. The laws of a given locality were sure to differ with those of every other locality, the point of greatest resemblance being that these rights were confined to residents of the particular town or community.

In one large bay the land granted to an individual was limited to three acres, at an annual rental of five dollars per acre, while in another bay the limit was five acres at three dollars per acre, an effort always being made to increase the revenues of the town or community by the income from these grants, while nothing was done by the town to protect its lessees in their rights. No hydrographic surveys were made. Lessees fixed their own stakes or buoys marking the boundaries of the lots. These marks being constantly removed by tides, ice and storms, led to contentions between adjacent owners. Larceny of planted shellfish was a

crime almost impossible of punishment, property lines being very uncertain and the visible marks unreliable. Under that expensive system doubtful or experimental ground was not taken. Extensive growers, requiring grounds in different localities suitable for different stages of shellfish growth, were obliged to use subterfuge and employ men resident in each locality to rent grounds as though for their individual use, when, in fact, they were to be used by the larger planters.

Under the local system efficient means of destroying the enemies of the shellfish, involving the use of steamers, was out of the question. Under the present system of State control the planters may obtain sufficient lands, employ capital to advantage, combat the natural enemies of the shellfish and have the benefit of proper surveys and boundaries, the lines being accurately fixed and easily relocated when necessary.

While the shellfish business under State care has made great progress toward escaping from the bondage under which it so recently labored by reason of being held within town and county lines, it finds, in its now rapid development, that it is also hampered by being held back at State lines.

This situation is particularly apparent upon the boundary line, in Long Island Sound, between this State and the State of Connecticut.

Interstate Conferences.

After several conferences between the authorities in Connecticut and your Superintendent of Shellfisheries, the matter was taken up by the Legislature of Connecticut at its recent session and the following resolution adopted:

SECTION 1. That the Governor is directed to appoint a Commission consisting of six persons, three of whom shall be the Shellfish Commissioners of this State.

SEC. 2. Said Commission is authorized, empowered, and directed to confer with the Forest, Fish and Game Commission of the State of New York, in relation to proposed reciprocal legislation concerning lobster and shellfisheries in the waters of the State of New York and the State of Connecticut. Said Commissioners shall be paid their actual expenses when approved by the Comptroller.

SEC. 3. Said Commissioners shall report to the Governor on or before September 1, 1904, the result of their conferences, together with recommendations of such legislation as may seem to them practical and desirable. The Attorney-General shall thereupon prepare appropriate bills, embodying such proposed legislation, to be submitted to the next General Assembly.

During the summer of 1903 the following named gentlemen were appointed as members of this Special Commission, to wit: The members of the Connecticut Shellfish Commission (Mr. Waldo, Mr. Schwartz and Mr. Atwater); Senator Hamilton, Chairman of the Senate Committee on Fish and Game; Assemblyman

Arnot, Chairman of the Committee on Fish and Game of the House of Representatives; Mr. Pike, and General William A. King, Attorney-General.

On November 9, 1903, your Superintendent received a notice from General King of a meeting of the Special Commission, to be held at the office of the Shellfish Commission, at New Haven, on Monday, November sixteenth, requesting his presence.

The New Haven meeting was organized with Senator Hamilton in the chair. Your Superintendent being called upon for a statement of his views upon the issues under discussion, read a report covering the matter which he had, in the spring of 1903, submitted to the Forest, Fish and Game Commission of New York State, as follows:

OFFICE SUPERINTENDENT OF SHELLFISHERIES,
NO. 1 MADISON AVENUE.

NEW YORK, *March 9, 1903.*

To The Forest, Fish and Game Commission, Albany:

GENTLEMEN.—Following a correspondence, which has covered a period of over two years, conferences have recently been held, in Hartford and in New York, with the Connecticut State authorities for the purpose of giving effect to recommendations made by your Superintendent of Shellfisheries in November, 1900, and published in the Sixth Report of the Commission. It was then suggested that, in view of the fact that upon the statute books of both States were laws limiting the right to take shellfish in public waters to citizens of each State respectively, some legislation of a reciprocal character should be enacted in the two States, which, in its operation, might be beneficial to the residents of both States. Between Long Island, in the State of New York, and the coast of the State of Connecticut, lies Long Island Sound, an immense arm of the sea. The interstate boundary being a line about one hundred miles in length, established along what is practically the center of the Sound, the shellfish cultivators being restricted in their operations to one or the other side of this line, accordingly as their place of residence is in one State or the other, naturally questions have arisen affording problems of greater or less difficulty.

In the month of July, 1900, one John Green, a resident of Connecticut, was arrested while taking lobsters in the Sound near Port Jefferson. He paid a small fine after pleading guilty. At the hearing, in the presence of the justice, he said that it was scarcely fair to take him alone—that more than one hundred men from Connecticut were regularly taking lobsters in “The Race,” southwest of Fisher’s Island. Green, upon saying that he knew these persons, was requested to notify them that they must not continue to violate the law. One month later some arrests of non-resident lobster fishermen were made near Fisher’s Island. One of these defendants made a contest, but was unsuccessful in the courts. The Forest, Fish and Game Commission, recognizing the hardships likely to fall upon the

citizens of either State under the non-resident law, and adopting the solution proposed, recommended in their Sixth Report "That there should be no discrimination by this State, in the matter of hunting or fishing, against any citizen of the United States, except in cases of citizens of States which discriminate against the State of New York."

Counsel for the Connecticut lobster fishermen undertook to prepare a measure for enactment in both States and was promised the endorsement of this Commission, but later reported that his clients were not prepared for this full measure of reciprocity. At this time the Legislatures of 1901 were in session in the respective States. In 1902 the question was taken up with Hon. Charles Phelps, then Attorney-General of Connecticut, and with the Shellfish Commissioners of that State, without result.

Hon. William A. King, the present Attorney-General of Connecticut, has become interested in the subject, and at his invitation your Superintendent visited Hartford on February sixth and conferred with the Attorney-General, the Shellfish Commissioners, the Fish and Game Commissioners, the respective Chairmen of the Senate and House Committees on Fish and Game, and others.

This conference resulted in an agreement to recommend in the two States legislation of a reciprocal character, under which citizens of both States might enjoy mutual rights in the shellfisheries so far as these fisheries are within the jurisdiction of the State governments, with the exception of the use of the natural growth seed-oyster beds, which our neighbors thought should be reserved for the people of each State respectively. It was believed that such an arrangement would greatly benefit the shellfish industry and give effect almost fully (for it stopped a little short of full reciprocity) to the ideas for settlement expressed by this Commission for more than two years past.

The conclusions of the meeting at Hartford on February sixth, however, did not seem to be pleasing to some of the Connecticut planters, and a hearing was announced for February twenty-fifth before the joint committees, and your Superintendent was notified that his presence would be desirable. At this hearing a number of Connecticut oyster planters was present, and it was urged by them that they should be allowed, under any new plan, to take lands in Peconic and Gardner's Bays in New York. It was explained to them that these lands were not under State jurisdiction, having been ceded by the State to the County of Suffolk in 1884, and that if shellfish lands under local New York jurisdiction could be opened up to them, it would involve a similar privilege to New York planters in Connecticut local jurisdictions. The lands under the waters of Peconic and Gardner's Bays are, by law, excluded from State jurisdiction so far as making grants for shellfish cultivation are concerned, and as they are not located upon the coast of the Sound and are not in their position opposite to the coast of Connecticut, they cannot be considered in this arrangement.

Some of the Connecticut towns hold, under ancient grants, shellfish lands over which jurisdiction and control is held by said towns, and it was not supposed that such control would be affected by the reciprocal legislation proposed.

By reason of the overanxiety of the Connecticut lobster fishermen to fish in "The Race," in this State, and of the Connecticut oyster planters to be permitted to take shellfish lands in Gardner's and Peconic Bays, some measures have been proposed and bills introduced in the Legislature of Connecticut (apparently for the purpose of securing action of the New York authorities in the matter) which are, in their provisions, detrimental to the shellfish interests of citizens of New York, to wit: House Bill No. 446 declares forfeited all grants and franchises held by non-residents of this State in shellfish lands; House Bill No. 233 provides that oysters from the natural oyster beds of Connecticut shall not be conveyed out of the State within two years from the time said oysters are taken from the bed.

In explanation of what is intended to be secured by Bill No. 446, it should be stated that in former years, by reason of a lax enforcement of the shellfish laws, non-residents in both States have taken assignments from original grantees of oyster lands. It will therefore be understood that many planters residing in New York are cultivating lands in Connecticut and vice versa, and that the enactment of this measure would involve an ejectment of New York planters from grounds thus held in Connecticut.

House Bill No. 233 affects the right, as it at present exists, of residents of New York to purchase seed oysters from the natural seed beds of Connecticut, and if enacted would deleteriously affect the interests of our planters.

It is but just to say that neither of these measures meet the approval of the Shellfish Commissioners of Connecticut, nor of the Attorney-General of that State, nor of any Connecticut official, so far as your Superintendent is informed; in fact, a bill amending Section 3215 of the General Statutes of Connecticut has been drafted by the Attorney-General of that State, under the provisions of which reciprocal rights, as proposed by the New York Commission, will be secured so far as that State is concerned. It also confirms to citizens of New York State title to such shellfish lands as they may have taken by assignment from residents of Connecticut.

It has also been proposed by the Connecticut authorities that, if necessary, a Commission shall be appointed by the Governor to confer with the Forest, Fish and Game Commission of New York State for the purpose of considering and reporting upon the questions at issue.

Respectfully submitted.

B. FRANK WOOD,

Superintendent of Shellfisheries.

It was agreed by the gentlemen present, all of whom, except Mr. Atwater, had attended the Hartford and New York conferences, that in his report your Superintendent had stated the matter fairly and correctly.

After a short discussion of the matters involved an adjournment, subject to the call of the chair, was taken.

The Boston Convention.

A convention of the Commissioners of the lobster-producing States and British maritime provinces was held at the State House at Boston, Mass., on Wednesday, September 23, 1903, upon the call of Hon. Joseph W. Collins, Chairman of the Department of Fisheries and Game of the Commonwealth of Massachusetts, for the purpose of considering what can be done to secure a better protection of the lobster; and, if possible, to obtain laws upon this subject as nearly uniform as possible in the various States and provinces. It was fully appreciated that some immediate and concerted plan must be adopted to prevent the ultimate commercial extermination of the lobster.

The Dominion of Canada, and Maine, Massachusetts, Rhode Island, Connecticut and New York States were represented. The convention continued for two days and developed much of interest and importance.

Upon the organization of the convention Captain Collins was called to preside, and Dr. George W. Field, of the Massachusetts Institute of Technology, who for several years has made a specialty of investigating the habits and natural history of the lobster from a scientific standpoint, was elected secretary.

In his address Captain Collins called attention to the fact that the statute laws existing in the several States have proved entirely inadequate to prevent the considerable and continuing diminution in the supply of lobsters. He stated that the question before the convention was, "Shall present conditions continue, or shall we endeavor to bring about the adoption of uniform rules in the different municipalities which may insure the conservation and proper protection of these crustaceans?"

The following recommendations were reported by a committee consisting of Captain J. W. Collins, of Massachusetts; A. R. Nickerson, of Maine; E. H. Greer, of Connecticut; B. Frank Wood, of New York; W. H. Boardman, of Rhode Island, and Dr. George W. Field:

First.—We recommend that a law be enacted to limit lobster catching to men having permits from the State; that the penalty for catching lobsters without a permit shall not be less than \$100, and that a person convicted of violating the laws for the protection of lobsters shall have his permit revoked, and that no other shall be issued to him for a year thereafter.

Second.—The committee recommends that it is our desire, if possible, to have uniform, or nearly uniform, laws for the protection of the lobster in the New England States and New York, more especially so far as the legalized length of the lobster is concerned.

Third.—Your committee further recommends the general adoption of the law relating to lobster meat now enacted in the statutes of Maine. [The Maine law allows the sale of lobster meat in the shell only, so that lobsters shorter than the legal limit, known in the trade as “chicken” lobster, may be more readily detected.]

Dr. George W. Field advanced a theory regarding the protection of lobsters which deserves careful consideration upon the part of those who are making a study of this interesting subject. He maintains that it is the egg-bearing, or “berry,” lobster, rather than the immature lobster, that needs protection, on the same principle upon which the laying, or mother, fowl is preserved while the broilers are sent to market. He proposes to create a perpetual close season for the adult breeding lobster by putting it out of the power of fishermen to capture them. To secure this condition he suggests legislation limiting the size of the orifice or ring at the entrance to the lobster trap, so that it will be impossible for a lobster more than eleven inches in length to enter. As all lobsters above this size will be excluded, they will consequently never come into the hands of the fisherman, and therefore there will be no temptation for him to surreptitiously market them. He thinks that lobsters between eight and eleven inches are of suitable size for market, and are superior to the larger ones for the table.

It was suggested by your Superintendent that lobsters too small for the market might be allowed to escape from the traps by making the space between the side-bars or slats sufficiently wide to enable them to pass out. Under such a plan fewer small lobsters would be brought to the surface when the traps are raised, while absolutely none above eleven inches in length would be taken.

The minutes of the convention, it is expected, will soon be in print and ready for distribution, when copies will be forwarded to the New York Commission.

During the season multitudes of young lobsters have made their appearance upon our coast, notably in the New York Lower Bay and in Jamaica Bay. This gives encouragement for an increased market supply in the near future.

Statistics of the Industry.

Though without an appropriation for this purpose, an effort has been made by your Superintendent to gather statistics of the shellfish industry. The results presented in this report are of very great interest, and, while not as complete as they may be in the future, bear out the estimate made two years ago by this Department—that New York annually transacts a business in shellfish amounting to about \$7,000,000.

The preparation of statistical returns being a new thing, it was impossible to get reports from every planter and dealer. However, with the assistance of the common carriers, freely given, and with the cooperation of a majority of the planters and market men, we are enabled to show the great development of the shellfish business under State control, covering the cultivation, marketing and export trade.

On or about October 1, 1903, the following letter, with question blank enclosed, was sent out to shellfish cultivators, to wit:

OFFICE SUPERINTENDENT OF SHELLFISHERIES,
No. 1 MADISON AVENUE.

NEW YORK, *October 1, 1903.*

DEAR SIR.—For the purpose of obtaining reliable statistics of the extensive and growing shellfish industry of the State of New York (pursuant to the requirements of Chapter 433, Laws of 1903) you are requested to kindly answer the questions upon the enclosed blank and send the same by return mail to this office.

The information obtained in this manner from individual planters, firms and corporations will be held as being of a strictly confidential nature. This is a matter of necessity and importance and is required by law (as above cited).

Please give it your immediate attention, and oblige,

Yours respectfully,

B FRANK WOOD,

Superintendent of Shellfisheries.

This letter brought returns from about one half of the acreage held under State leases and franchises, as shown by the following summary compiled from the statistics furnished:

SUMMARY.

Acres held under lease	6,274.0
Acres held under franchise	7,694.2
Total acres cultivated	9,274.7

(Location of tracts—Jamaica Bay, Princes Bay, Long Island Sound and tributary bays and harbors, Great South Bay, Raritan Bay.)

Number of steam vessels employed	71
Tonnage of steam vessels	1,223.08
Value of steam vessels	\$299,850 00
Value of outfit	121,585 00

SUMMARY — (*Concluded*).

Number of sail vessels employed	104
Tonnage of sail vessels	1,372.32
Value of sail vessels	\$84,100 00
Value of outfit	44,375 00
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Number of other boats employed	392
Value of other boats	\$35,944 00
Value of outfit	28,206 00
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Number of tongs used	722
Number of dredges used	446
Number of hands employed	870
Amount paid in wages	\$258,015 41
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Value of shore property	\$88,950 00
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Bushels of market oysters produced	879,861
Bushels of seed oysters produced	138,559
Bushels of seed oysters planted	755,419
Bushels of seed oysters sold	90,803
Value of seed oysters sold	\$37,151 50
Value of market oysters sold	1,052,841 62
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Bushels of clams produced	26,813
Value of clams sold	\$58,742 09
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Principal market — New York and Europe.

This does not imply that the production is double the amount specified, for one grower with ten acres may produce more marketable oysters than another with 100 acres. The same applies to all the statistics here given as to number, tonnage, values of vessels employed, number of men employed, quantity and value of equipment, value of shore property, amounts paid in wages, etc.

Careful efforts were made to secure from various transportation lines the quantity of oysters brought to market in the course of a year. In very few instances were the figures immediately available, as no separate records of oyster shipments were kept. Officials and employees very courteously estimated the quantities and offered all the aid possible in determining the volume of business. In nearly every case, however, the figures were given, not as officially exact, but rather as underestimates. Hence it may be assumed that the oyster trade of New York

State in a year, as reckoned from the business of the carriers, is rather more than less than the figures given. Reckoning the quantities of oysters sent to market in the shell and "shucked," or opened, the total number of bushels represented in the transportation companies' reports amounted to 6,275,000. As the average wholesale price of oysters amounts to one dollar or more per bushel, this represents, in round figures, a valuation of \$7,000,000 annually.

As indicative of the variation of the sale of oysters during the twelve months of the year the following report of one year's shipment by freight on one transportation line will prove instructive, remembering, of course, that these figures are estimated and are intended to understate rather than exaggerate the volume of business:

	Net tons.
January	2,500
February	2,500
March	2,000
April	1,000
May	290
June	267
July	200
August	162
September	1,372
October	2,584
November	3,500
December	3,500
Total tons	19,875
One ton equals, barrels	9
Nine barrels to ton equals, barrels	178,875
Three bushels to barrel	3
Total bushels	536,625

New York City Oyster Markets.

In New York City there are two principal oyster markets: the West Washington Oyster Market and the Fulton Market. The business of the oyster dealers is principally done in large house-boats, or floats, moored at the water fronts. These unique craft are familiar and picturesque objects to New Yorkers. The use of these boats has grown from the necessities of the business. Proper houses upon the wharfs or docks are scarce and would be hard to obtain. The use of the floats

is a measure of economy, the cost of dockage being one dollar and ninety cents per day; and it is then said that the oyster merchants are discriminated against, as canal boats, occupying greater space, are docked for twenty-five cents per day. Canal boats are transient customers at the docks, while the oyster boats are permanently located.

These oyster houses rise and fall with the tides, and are therefore always upon the level of the boats comprising the oyster-carrying fleet, and thus are favorably situated to have the cargoes transferred. There are nineteen of these floats at West Washington Market and seven at Fulton Market.

The Oyster Fleet.

Subsidiary to the large market floats are perhaps 500 boats engaged in the trade of carrying oysters from the oyster beds to the market. This fleet comprises boats of almost every description, including steamers, naphtha-power boats, schooners and sloops, and they carry loads varying from 300 to 5,000 bushels each. Five hundred bushels is probably a fair average cargo for a sailing vessel. In addition to the boats, there are from fifty to sixty wagons regularly employed in taking oysters to market from the Rockaway beds. These wagons are built upon the lines of the Long Island market gardener's wagon, and carry a load of 21,000 oysters, put up in bags, containing about 400 oysters to the bag.

Oysters in the shell are shipped to the retailers in barrels and bags, and the opened ("shucked") oysters in half barrels and tubs.

There are about 250 oysters, in the shell to the bushel; these, when opened, give about one gallon of solid meat. A half barrel holds eighteen gallons, there being twelve gallons of solid oysters. The tubs contain nine gallons, with six gallons of meat.

Motor Boats.

A great saving in time and money in the handling of oyster stock is being wrought by the employment of power boats in the business. Indeed, the trade is being revolutionized by the rapid advancement in this respect, as many more trips can be made and much larger burdens carried than with the old-time oyster craft. This, with modern processes of refrigeration in transit, is doing wonders for the business.

Shipments of oysters to European ports began on October twenty-second, and have now amounted (in less than two months) to 6,925 barrels. During the fall shipments amounting to five carloads daily have been made to California. Oysters now go everywhere, and can be delivered in good condition at remote points.

Great numbers of markets, groceries, etc., throughout the country are engaged in handling the bivalves, and constitute an important factor in the ever increasing demand.

Oyster Culture.

The large increase in the quantity of oysters produced and marketed is an evidence of the popularity and high dietetic value of this palatable and easily digested sea food. It has been pointed out by the *Lancet* that the nutritive material in a raw oyster comprises all classes of food substances, including proteid, carbohydrate, fat and certain mineral salts which are present in a peculiarly assimilable form.

That the oyster can be propagated by artificial means has long been known, the difficulty having been to apply the methods economically upon a commercial scale. Experiments for this purpose are constantly being carried on by the United States Commission of Fish and Fisheries. The process in use by oyster planters, usually spoken of as "cultivating" the oyster, consists in assisting nature to the extent of preparing suitable beds upon which the spat or spawn can attach itself and make its growth. Slime and mud are fatal to the young oyster. It is therefore necessary for the planter to thoroughly clean his ground under water by use of the dredge. He then covers the bottom with shells which have been cleansed by scouring and drying, or with clean broken stone. This preparation, in the case of the larger tracts of oyster land, may cost many thousands of dollars, which are literally cast upon the waters in the hope that the oyster spat may attach.

The oyster exudes thousands of eggs, which are carried along by the tides until a clean, hard surface is encountered, when, if the limit of existence in the free-swimming stage has not been reached, it attaches, and there it remains during its life history, unless removed by the planter to other grounds. The uncertainties of the business to the planter are apparent. The spawn from the oysters upon his own grounds may be carried miles away by the currents, while the set upon his lands comes from an unknown quarter; or he may fail entirely to get a set, with the result that the money spent by him in preparing the beds has actually been thrown overboard. Thus, from an oyster farm, other lands may be fertilized and enriched.

There is occasionally a season during which the oyster set is abundant and general and when all goes well with the planter, but usually the set occurs over small areas or spots, and often there is a season showing almost an entire absence of oyster set. The oyster requires from three to five or more years to mature, so that the business can endure for a few years a dearth of the spat. There has been no general oyster set in New York waters since the year 1899. The abun-



OYSTER FLOAT AND SLOOPS—OYSTER BAY.



ALONG THE STREET FRONT.

WEST WASHINGTON MARKET, NEW YORK CITY.

dance of that year has ever since furnished the trade with market stock and will carry the dealers over another year, during which, however, higher prices may be looked for. Should the next season not prove more bountiful in this particular the planters will be in dire straits.

Minute oysters, known as "seed" oysters, are regularly dealt in and carried from one locality to another and transplanted. Our growers usually purchase large quantities of seed from the Connecticut natural beds, but our Connecticut neighbors, as well as our own people, have lately failed to find a set. Seed oysters from Southern waters will not thrive upon our colder coasts, though Northern seed prospers well in the South. Our planters, consequently, cannot be supplied from that source; we have, therefore, to face a condition of scarcity of oysters during the next two years. No doubt nature could always, under normal conditions, be depended on to renew and perpetuate this species, but it must be remembered that by the agency of man the natural beds have been depleted and nature's balance disturbed. Notwithstanding the deadly attacks of the starfish, the borer, the periwinkle and other enemies of this bivalve, nature has always provided for the survival of the oyster; but when the oystermen rake up the shellfish of entire bays and arms of the sea it will be understood that every advance in intelligent methods of cultivation is welcomed, and that experiments such as the General Government is making along the line of artificial propagation are watched with the greatest interest.

Our New York oyster is the best and most sought shellfish that the market affords. Blue Points, East Rivers, Rockaways and those from Princes Bay are too well known and too highly esteemed to require further mention here. Our domestic markets demand them, and thousands of barrels are exported to foreign countries. Perhaps it may be of interest to note that we also import oysters, though the quantities imported are infinitesimal in comparison with the exports; still there are certain epicures who, to satisfy a taste which might properly be called a fad, require that the bills of fare at their favorite restaurants shall afford "Green Marennes," a French oyster, which, to the extent of five or six barrels a week during the season, are brought to this country. While the New York oyster is unsurpassed in quality and may be had fresh from its salty medium, its foreign relative commands a fourfold greater price.

A Hazardous Occupation.

Some of the difficulties which make the business of oyster culture hazardous and laborious have been mentioned, but more might be related; in fact, more exist than are actually known, such as storms, tides, temperature of water and

the fate of being stifled by the smothering mud. One oyster planter relates the difficulties he encounters in oyster cultivation as follows:

DEAR SIR.—I am in receipt of your request to fill out blank relating to oyster cultivation. It is impossible for me to fill this out as you request, but am perfectly willing to give you all the information possible.

In the first place, I do not know how much ground I have planted, as it is all creek bottom. I have permission and in some cases pay for the privilege of planting to the owners of adjoining uplands. The town presumably owns the bottom, but it was voted in town meeting not to lease any creek bottoms. This is largely an experiment, last season being the first year that oysters in any quantity were planted in this creek. The bottom planted does not lie in any continuous tract or tracts, but follows the shore largely and wherever bottom seems to be hardest.

Last season I planted about 700 bushels and did very well with them. This spring, in partnership with another party, I planted about 3,000 bushels; have had bad luck with them, so far losing, I should think, certainly one third by reason of a growth of moss or a mosslike substance growing from the bottom to a length of about six inches, forming a solid mat and smothering whatever oysters it covered. This growth occurred in the month of June. We also had another growth, which grows from bottom to top of water; this we could seine off, but the first named there did not seem to be any way of getting rid of. Have not as yet this season handled any oysters to speak of, so cannot tell number of bushels or value.

* * * * *

I am,

Yours truly,

* * * * *

Cultivation for Private Use.

There are some instances of citizens who have peculiar facilities for growing shellfish, or who, having wealth at command, can indulge their taste for fresh salt-sea oysters and clams by cultivating private shellfish beds. To mention a notable case: Last year Mr. Howard Gould leased from the State two tracts of land under the waters of Long Island Sound, upon which he immediately caused to be planted 2,500 bushels of young oysters. He reports under date of October 14, 1903, that he now has in cultivation about five acres located off Sands Point, and adds:

The lands which I hold at Sands Point were planted with sufficient oysters and clams for my own use only, and, as I have never sold any or kept any account of the amount I have taken out, it is impossible for me to answer many of the questions on the form you send me.

Clams.

The delicious and appetizing clams produced in this State (among which are the popular Little Necks and Rockaways) are far-famed. As the natural supplies have continued to diminish, planters have, in many instances, given careful attention to cultivating this succulent bivalve. Notably, in Jamaica Bay they have been successfully grown in considerable quantities. No difficulty has been experienced in disposing of the stock right at the beds at good prices. Clams, although a staple article of trade, are especially sought at times when the oyster is out of the market. Our native stock finds ready sale, often bringing from ten dollars to twelve dollars per barrel.

The Menhaden Catch.

The Menhaden fishermen have enjoyed two years of plenty following upon several years of scarcity. The vicissitudes of this business are common to all coast fisheries and tend to prove the theory that ocean fish have their periods of being scarce and plentiful entirely irrespective of any agency of man. This fluctuation of supply is well understood by fishermen. The Menhaden business has, during the year, yielded results as follows:

Number of steamers	30
Catch of fish (about), barrels	1,500,000
Oil made (about), barrels	70,000
Scrap (about), tons	40,000
Value (about)	\$1,500,000

Food Fisheries.

Food-fish of all kinds have been fairly abundant upon our coast. Bluefish, however, did not come North in as great abundance as during last season, but were plentiful in Southern waters. The net fishermen in the vicinity of Montauk Point and along our outer coast line have been favored with large catches which have brought satisfactory prices in the market, making for this season prosperous times for those engaged in this hazardous and often unprofitable occupation.

Respectfully submitted.

B. FRANK WOOD,

Superintendent of Shellfisheries.

NEW YORK, N. Y., December 30, 1903.



The Cultivated Forests of Europe

BY A. KNECHTEL.

THE general interest in forestry affairs which now occupies largely the attention of the people in this country, has led to discussions in which European forestry methods are frequently referred to as a desirable system to be followed in the management and exploitation of American woodlands. In view of this fact it may be well for the casual reader, who is interested in this subject, to devote a little time to a study of the methods employed in the maintenance and management of European forests in order to determine how far they are applicable to the lumber business, and to forestry in general, in our own land.

It would be impossible, within the limited scope of this article, to discuss all the questions involved, but a brief statement of the salient facts, together with a short description of certain fundamental and controlling conditions, may assist largely in understanding the differences which necessarily exist in the conduct of the business as now carried on in the two countries.

Nor is it intended that this article shall be especially instructive to foresters. It is written rather with the hope that it may interest the general reader, permitting him to consider certain forest conditions without having his patience taxed with mathematical calculations or technical phraseology.

Why the Forests Are Clean.

In the cultivated forests of Europe the absence of underbrush and fallen, decaying logs and limbs, the density of the forest, and the even distribution of trees, often planted in long, straight rows, arrest immediately the attention of the American visitor. One can stroll with comfort among the trees, or drive anywhere among them, except, of course, where the hills are too steep or stony, or where the trees stand too closely together, the latter being always the case in young woods.

In these forests trees are not permitted to reach the full limit of their life, and then, as the result of decay, to fall and remain rotting on the ground. They are considered as a wood capital which adds interest to itself as long as the trees continue to grow, at first slowly when the trees are small, more rapidly when they are of medium size, and more slowly again when they become large. When the trees die the wood interest ceases entirely, and as they decay the

capital itself is reduced. The forester leaves this wood capital as long as interest continues to add to it satisfactorily. Then when the growth declines, whether on account of insect attack, disease, or old age, until it no longer warrants leaving the timber in the forest, it is removed, the forester taking the trunks and limbs and the peasant gathering up the brush and often digging out the stumps, although these also are not infrequently taken care of by the forester and placed on the market, bringing always a price sufficient at least to pay the cost of their removal.

Everywhere in the woods of southern Europe may be seen people gathering brush and taking it home in carts, drawn frequently by cows or dogs. Often, however, it is tied into a bundle and carried, sometimes a long distance, strapped on the back or poised on the head. Permission to gather brushwood for fuel is usually given free of charge. In some places a nominal sum is charged; in others the workmen in the woods are granted the privilege as an extra compensation for their labor. Sometimes with this permission goes also the privilege of gathering leaves and nuts, the leaves being fed to goats, or used as bedding for horses and cattle. The nuts are mostly used as food for domestic animals; but many of the poor people dry the acorns and use them in place of coffee. In the cities of Italy pine cones are peddled on the streets.

In the Spessart, in Bavaria, it has been so long the privilege of the peasants to gather litter from the forest that it is now considered their right, and even so recognized by law. The privilege has its restrictions, however, which have been stated as follows by Sir Dietrich Brandis: "It must not be exercised in young woods which have not yet attained half the age prescribed by the term of rotation;* further, an area where litter has been collected must have at least six years' rest before it is again opened for that purpose; and lastly, the areas opened for the collection of litter must be assigned annually by the responsible forest officers, and this is done in accordance with a well-considered plan. Nevertheless, the quantity of leaves removed annually is enormous. In spring and autumn long strings of wagons filled with huge mountains of litter leave the forest in every direction, and the result is that the soil does not improve as much as it might, and in places it is much impoverished."†

In some districts all products of the forest are put upon the market. In a forest belonging to the city of Grabow in Mecklenburg a good layer of leaves and moss sells for sixteen dollars per acre.

*The term of rotation prescribed for oak is 300, for beech 120, for Scotch pine 96, and for spruce 72 years.

†Garden and Forest, May, 1894. "Mixed Oak and Beech Forests of the Spessart," by D. Brandis.



A. KNECHTEL, PHOTO.

HEAPS OF PINE NEEDLES AND MOSS READY FOR MARKET.

CITY FOREST OF GRABOW, MECKLENBURG, GERMANY.



A. KNECHTEL, PHOTO.

BUNDLING SPRUCE FAGOTS FOR MARKET.

NEAR TITISEE, IN THE BLACK FOREST.



A. KNECHTEL, PHOTO.

GOING HOME FROM THEIR WORK IN THE FOREST.

NEAR OBERWIESENTHAL, IN THE ERZGEBIRGE, SAXONY.

Methods of Culture.

In European forests there is always a large quantity of small timber for sale on account of the manner in which the forests are cultivated. Pine and spruce trees are mostly started in nurseries, in which beds are made and seed is sown in much the same way as in the vegetable garden. After growing in these seed beds for two years* the little trees, then about six inches high, are transplanted into other beds, where they are spaced about five or six inches apart, and where they remain for two or three years more. They are then about a foot or fifteen inches tall, and are taken to a field from which the forest has been removed and are set in the ground spaced only four feet apart, or thereabouts, so that in a short time they will crowd each other. This crowded condition compels the trees to grow tall and slender and to shed their lower branches, thereby permitting a growth of timber free of knots. It also hinders evaporation by shading the soil, a matter of prime importance. After attaining a satisfactory height growth the trees take on a diameter growth in due time. The trees are usually planted in straight rows, in some cases by means of a rope stretched across the field as a guide.

If the soil is of a good quality the ground receives no previous preparation, except that the stumps may be taken out. In light, sandy soils it is a common practice to run furrows about three feet apart. A surface plow with a double moldboard is used, which goes about eight inches deep. This is followed, in the same furrows, by a narrow subsoil plow which sinks to the depth of one foot, and which is usually drawn by two teams.

Instead of being plowed, the ground is sometimes dug with a spade. The diggers advance in straight lines across the field making square holes, twenty inches on a side and twenty inches deep, the soil removed in digging each being thrown into the preceding hole. The soil thus loosened retains the moisture better. Pine is almost invariably the species planted in such poor, sandy ground.

In about twenty years a thinning is necessary, as the trees then crowd each other so much that many are suppressed, in more or less degree, by their stronger neighbors, and these latter are also hindered materially in their growth. In spruce forests sometimes more than half the trees are removed in this first thinning. These are sold for firewood, poles and various other purposes. The fuel wood brings, laid at the roadside, about two dollars and twenty-five cents a cord, the

* Scotch pine is, in many localities, taken from the seed bed directly to the field when it is one year old. If left for a longer time in the nursery, it is much damaged by a fungal disease called "Schütte."

poles selling for various prices, according to their size and form. As the crowns of the trees soon close again, subsequent thinnings are necessary about every ten or fifteen years, the better sticks being taken for building purposes while the rest go mostly for pulp-wood if spruce, for firewood if pine, all sorts increasing in price with the quality. Building material laid at the roadside brings about nine cents per cubic foot; good spruce fuel wood about three dollars a cord.

On the poor, sandy soil of Mecklenburg a thinning in Scotch pine, when the trees are twenty years old, yields about two dollars per acre; when forty, five dollars; when sixty, ten dollars; when eighty, twenty dollars; when one hundred, thirty dollars. The total wood from thinnings gives about one hundred and thirty dollars per acre. On good soil in the Erz mountains, Saxony, a thinning in spruce, when the trees are twenty years old, yields four dollars per acre; when forty, fifteen dollars; when sixty, eighty dollars. The total wood from thinnings yields about two hundred dollars per acre. The thinnings largely offset the cost and interest on the plantation up to the time of the final cutting.

The final cutting is not often made before the trees reach the age of eighty years. Sometimes they remain until they are one hundred and twenty years old, especially where the soil is poor or the climate severe. These are the finest trees in the forest, the diseased, deformed or injured ones having been removed in the successive thinnings. Then about one hundred and sixty to two hundred straight, cylindrical trees, twelve to fifteen inches in diameter and about eighty feet high, with shafts free of branches, stand on an acre, offering in all about 40,000 to 50,000 feet of lumber and selling on the stump for from \$500 to \$600. These are felled and taken from the woods in almost full tree lengths. It is common in Europe to see logs sixty feet long being hauled from the forest.

In Germany the forest is managed largely in compartments, each of which, when the mature trees are considered ready for removal, is cut clean and planted with the new crop. Sometimes the compartments are located so that the cutting proceeds regularly in a certain direction, usually from east to west as a protection against the prevailing winds, the cuttings being made at intervals of perhaps ten years, in which case the forest shows distinctly ten or twelve age classes arranged in a series of progressive heights. If a compartment is harvested and restocked each year, the number of age classes will, of course, equal the age to which the trees are allowed to grow. This method of cutting clean and planting is the one most commonly in use in the pine and spruce forests of Germany.

Instead of planting the field with young trees, it is occasionally restocked by sowing seed in spots hacked in the soil, the spots spaced about four feet apart. Scotch pine seems to do quite well planted in this way, especially where the soil



A. KNECHTEL, PHOTO.

STAR-SHAPED PLANTATION, WITH ROADS RADIATING FROM COMMON CENTRES.

THURINGIA, GERMANY.



A. KNECHTEL, PHOTO.

PREPARING GROUND FOR A FOREST PLANTATION.

FORSTAMT HAIN, IN THE SPESSART, NORTHERN BAVARIA.



A. KNECHTEL, PHOTO.

A CLEAN CUTTING; PLANTED FOREST OF SPRUCE IN LEFT FOREGROUND.

NEAR DREIANNEN-HOHNE, HARTZ MOUNTAINS, HANOVER.



A. FRANCHI, PHOTO.

PLANTED FOREST OF SILVER FIR, FIFTEEN YEARS OLD.

NEAR CAMALDOLI, IN THE APENNINES, ITALY.

is fresh and the weeds few. European foresters place little dependence upon the reproduction of pine and spruce from self-sown seed, though one occasionally sees a forest fairly well stocked in this way, more frequently with pine than with spruce. Results with spruce may be observed at Baden-Baden in the Black Forest and at Winterthur in Switzerland.

Where the hills are steep and great danger of erosion exists a selective system of cutting is followed. The method is practiced in Germany, but is more common in the French Vosges and in Switzerland, in some places denudation being even forbidden by law. In a forest managed in this way there is a mixture of all age classes, the mature trees being removed and thinnings being made as the foresters deem advisable. In this case the young growth comes usually from self-sown seed.

A fir or beech forest is generally reproduced from seed that falls from mother trees left standing over the area to be restocked. These are left properly distributed and in sufficient number, not only for the dispersion of seed, but also to furnish the right degree of shade for the young crop to get started. Sometimes, when a full mast occurs on the beech trees, the ground beneath is hacked up for the reception of the seed, as it germinates more readily in the mineral soil. The distribution of the beechnuts is also aided by hand, and fail places are planted with trees from the nursery. After the growth is well started the mother trees are removed in the winter.

Fir and beech are very much alike in their growth requirements. Both species endure much shade; both are much injured by late frosts, and are sensitive to intense heat; hence, both need protection from mother trees. On account of this similarity of behavior the two species have in recent years been much cultivated in mixture.

Oak and beech are also grown together. Oak cannot endure much shade; the crowns of the trees must be kept constantly free from one another by thinning. Hence, beech, a good shade-enduring tree, is used as an undergrowth to shade the soil which otherwise would be much exposed to the drying influences of the sun.

When an oak forest is to be restocked, mother trees of oak and beech are left distributed over the ground. The soil is prepared by rooting up any little beech trees that may have started, as their shade would hinder the growth of the young oaks. This also brings some mineral soil to the surface. The ground is then left until seed falls, sometimes four or five years, unless the work is done during a seed year. If the beech seed falls before the oak, the growth from it is destroyed by raking the ground in the following spring after the beech seed has germinated, the object being to hold the ground ready for the oak. When

a seed year for oak occurs, after the acorns fall the ground is hacked up, generally in lines about three feet apart, and the seed covered.

Where no seed trees exist, or where a new forest is to be started, acorns are sown broadcast, twenty-two bushels per acre, and hacked into the soil in lines. Occasionally the whole area is dug up, but this is seldom considered necessary.

The beech is not permitted to come in among the oak until the latter has a start of a few years. It is then encouraged. By the time the oak is sixty years old the ground beneath is well covered with beech. Where it fails to come in from seed, small trees are planted. After the young growth is well started the mother trees are gradually removed, in several cuttings made in the winter, and the young growth is thinned out as necessity requires.

The beech, though shaded, grows more rapidly than the oak, and when it rises into the branches of the oak it is cut away and another generation started. Thus under one crop of oak is grown two crops of beech.

Pine, spruce, fir, beech and oak, one species of each, are the noble trees that make up the great cultivated forests of Europe, and in those forests the trees are raised from seed. But on many small areas coppice woods exist; that is, woods in which the young growth comes as sprouts from stumps. Oak for tanbark and firewood; chestnut for vine props; willow for basket twigs, and alder for turnery, are the common coppice trees, although other broad-leaf trees—ash, elm, birch, beech and maple—are somewhat so cultivated for firewood. The fuel wood of southern Italy is mostly obtained from coppice.

The trees are usually cut in late winter or early spring. At Naples the season, which is governed by law, is from September to March, but at higher elevations in southern Italy it continues through April. In Germany, oak for tanbark is cut in May and June; willow in August or December. The alder is usually grown in marshes and is cut while the ground is frozen. Coppice trees are cut down close to the ground and with an oblique section, so that the surface of the stump is quite smooth and allows the water to run off freely. Usually, scattered among the coppice, are trees grown from seed. In fact, these are indispensable to the perpetuation of coppice woods, as trees are soon killed by repeated cutting.

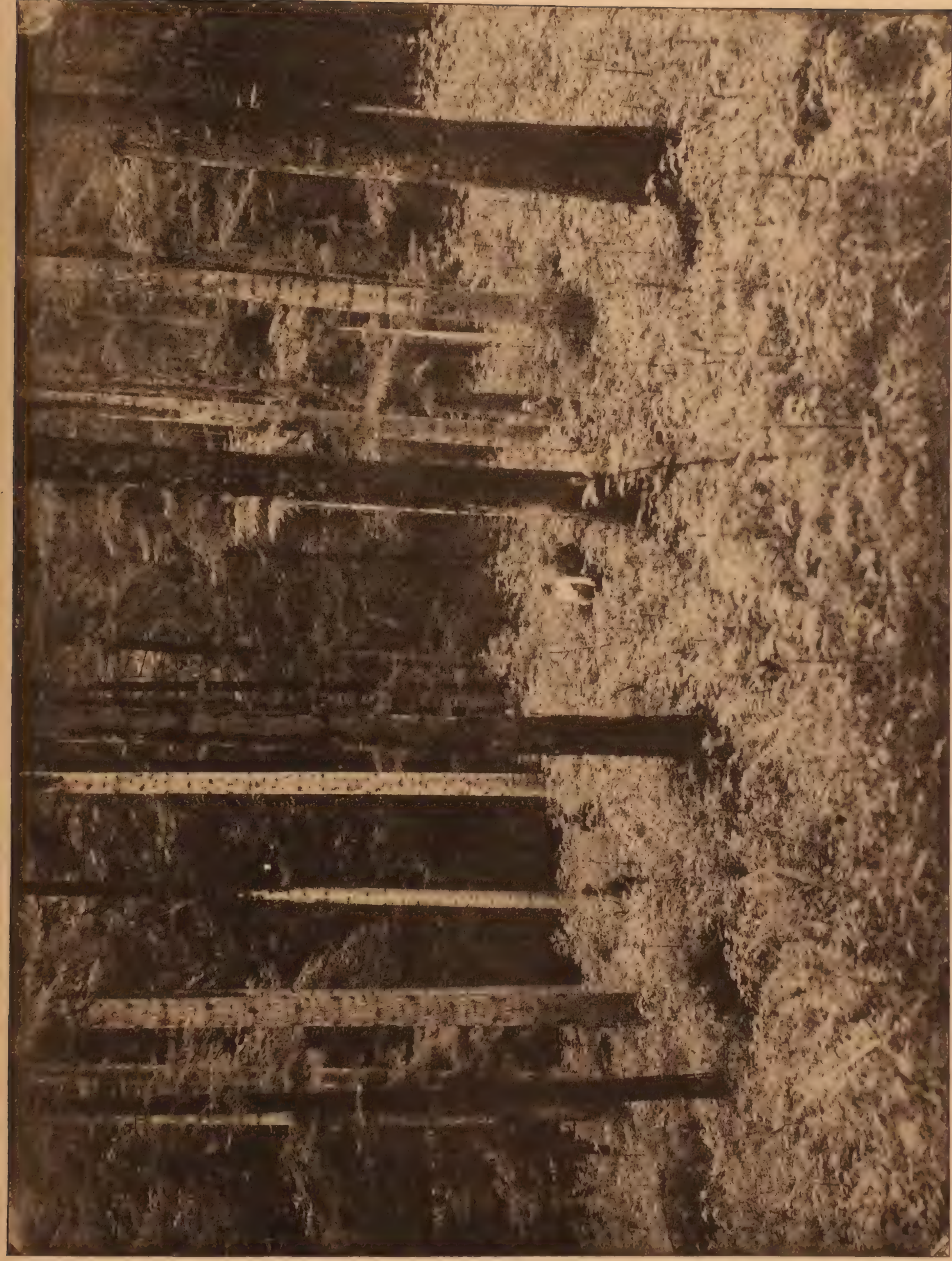
From the foregoing description of the manner in which forests are cultivated it becomes apparent that, whether the trees are raised from seed or from coppice, whether they are started in nurseries and afterwards set in the field, or are reproduced in the forest from self-sown seed, the forests all require thinning, and this throws upon the market large quantities of small material. Mr. Gifford Pinchot, in writing of the Sihlwald, a forest of 2,400 acres in Switzerland, states that



KARL PHILIP, PHOTO.

A THINNING FOR REPRODUCTION OF SILVER FIR, WITH TIMBER CUT FULL LENGTHS AND PEELED READY FOR TRANSPORTATION.

SULZBURG REVIER, PROVINCE OF BADEN.



KARL PHILIPP, PHOTO.

GROUND COVERED WITH NATURAL REPRODUCTION OF SILVER FIR SEED TREES HAVING BEEN LEFT FOR
THAT PURPOSE AFTER THE FINAL THINNING.

NEAR SULZBURG, IN THE SCHWARZWALD.

almost half the annual yield consists of thinnings. He says: "With an average stand of 2,800 cubic feet per acre, the annual yield of wood, almost half of which is from thinnings alone, reached last year 377,023 cubic feet, an amount which may be taken as slightly above the average."* None of this material from thinnings goes to waste. In short, all the products of the forests of southern Europe find ready utilization.

The Market.

This thorough utilization of the forest product is due to the good market, distribution of population, low wages and good roads. The effect of the market is everywhere apparent in the great economy of wood. In the hotels heat is a luxury for which guests are often required to pay an extra charge. In the wayside inn a bucket of hot ashes placed in the center of the room is often the only fireplace around which the smokers can hold their cheerful converse, while at night the bed is made ready for its occupant by a pan of coals hung beneath a chair placed under the blankets.

The houses in the villages, and even those of the workmen in the forest, are seldom constructed of wood. Walls of plaster or cement, with only sufficient wood to hold the material in place, are the rule; though houses of brick and stone are also quite common. The floors are very frequently made of stone, while the roof is rarely made of shingles, tile or iron being used instead. Wooden fences, plank sidewalks and block pavements are very uncommon.

In Germany, where forestry has been practiced for centuries, and where the art has had its highest development, the forests, which cover one fourth of the entire land area, fall far short of furnishing the country its timber requirement. In 1902 Germany imported logs and lumber to the value of \$21,991,200.†

Consul Henry W. Diederich, in his report dated Bremen, 1901, writes as follows concerning the demand for lumber in Germany: "The demand for lumber is steadily increasing, and it is utterly out of the question for Germany to ever supply that demand. In spite of all the high import duties placed on all foreign woods, which average 28 cents for every 210 pounds of rough timber or logs, and \$1.15 for every 210 pounds, or 1 cubic meter, of dressed timber, Germany has been unable to materially increase her forestry supply. In the year 1899 there were imported into Germany not less than 353,160,000 cubic feet of timber. During the same period Germany's own production amounted to from 565,056,000 to

* Publication of the American Economic Association. Vol. VI, No. 3, May, 1891. "Government Forestry Abroad," by Gifford Pinchot.

† Commercial Relations of the United States with Foreign Countries, 1903. Vol. I, p. 413. Report of U. S. Consul-General Frank H. Mason, Berlin.

600,372,000 cubic feet. If Germany were to supply this deficiency of 353,160,000 cubic feet of timber from her own soil she would need an additional acreage of 19,768,000 acres. In other words, the percentage of soil now devoted to forestry would have to be increased from 26 per cent to 40 per cent. But it is claimed that throughout all this empire not more than 2,471,000 acres fit for that purpose might be found. Even if every available nook and corner were thus utilized, and all of the waste lands that are not well adapted for agriculture were planted in pine and other forest trees, it would require, on an average, fifty years for them to be ready for market, and then the supply would not begin to equal the demand. Of all sections of Germany only Bavaria and Württemberg have a surplusage of home lumber, all the other districts needing a great deal more than they can ever produce."*

In Germany timber is not purchased by mill owners as in America, by general estimate. It is the custom to buy individual trees rather than forests. There is, however, in common use a market unit of volume by which timber is generally purchased called the "festmeter." It is a cubic meter and is equivalent to 1.44 markets, or 19-inch standards, or about 288 feet, board measure. But it is not used in quite the same way as we use the standard. In America, large and small logs are scaled and sold together, distinction seldom being made in the price per standard. In Germany, when the trees are felled, each one is marked with a number stamped in the butt. They are then sold by number in five or six classes, according to size, the larger logs bringing more per festmeter than the smaller ones. Logs are generally measured in the middle.

An idea of the activity of the German market for building material may be gained by a study of the following prices offered for spruce by a sawmill at Hasserode, in the Hartz, in 1904. Timber is purchased in the woods in full-tree lengths, felled and trimmed of branches. For tree trunks containing 530 feet, board measure, \$12 each; 450 feet, \$10.25; 383 feet, \$8.63; 325 feet, \$7.38; 276 feet, \$5.12; 233 feet, \$4.25; 196 feet, \$3.63; 161 feet, \$3; 132 feet, \$2; 104 feet, \$1.50; 81 feet, \$1.25. In other words, \$22.65 per 1,000 feet, board measure, was offered for tree trunks containing more than 300 feet; \$18.56 for trunks with from 150 to 300 feet, and for smaller sizes about \$15.

For poles suitable for rafters, if 23 feet long, \$1 each; if 20 feet long, 75 cents; if 17 feet long, 52 cents; if 13 feet long, 43 cents; if 10 feet long, 25 cents.

In the Spessart, oak was quoted in 1904 at the following prices for sound timber per 1,000 feet, board measure: Trees with middle diameter 24 inches and

* United States Consular Reports, 1901. Vol. LXV, p. 490. "German Market for American Lumber," by Henry W. Diederich.



A. KNECHTEL, PHOTO.

OAK AND BEECH.

NEAR ROTHENBUCH, IN THE SPESSART, BAVARIA.



A. KNECHTEL, PHOTO.

A GOOD SEED YEAR FOR NORWAY SPRUCE.

NEAR EISENACH, THÜRINGER WALD.

over, \$118; 21 to 24 inches, \$86.80; 18 to 21 inches, \$69.44; 14 to 18 inches, \$52.08; 10 to 14 inches, \$34.72; 8 to 10 inches, \$21.70.

Beech was quoted as follows: Logs with middle diameter 24 inches and over, \$35.60 per 1,000 feet, board measure; 21 to 24 inches, \$30.38; 18 to 21 inches, \$21.70; 14 to 18 inches, \$13.90; 10 to 14 inches, \$10.42; 8 to 10 inches, \$9.55.*

The live market for wood appears also in the number of metal ties one sees in the railroads of Europe. In Germany they are used in one fifth of the entire mileage. The use of wooden ties has, however, in recent years been greatly encouraged by the discovery of methods of impregnating wood with one of the following substances: creosote, chloride of zinc, sulphate of copper, corrosive sublimate, or a mixture of the salts of iron and copper, by which the durability of the wood is greatly increased. A beech tie, which ordinarily lasts about five years, may thus be made to last twenty years. The life of an oak tie is increased from fifteen to thirty years, a pine from six to twenty-four. A beech tie 8 feet 10 inches long, 6.4 inches high, 10.4 inches wide, with 6.4 inches top measure, costs, laid at the works, about \$1.06; an oak tie of the same dimensions, \$1.63; a pine tie, \$1.12. Impregnating with creosote costs, respectively, about 65 cents, 30 cents and 25 cents.

The Distribution of Population.

The distribution of the large population facilitates very much the removal of the forest products. The woodland districts are quite thickly peopled. Even in the Black Forest there are a great many villages and summer resorts, their population in the aggregate exceeding 1,000,000 people. If the Adirondack lakes were drained of water and their beds occupied by farms and villages the landscape would be quite similar to that of the forested regions of middle Europe. Thus the market is close at hand, at least for the small material, permitting its more extensive use.

The Low Wages.

With a large population everywhere close by, not only is the market better, but labor is more available, and at a lower price. Compared with the price of wood, wages in Europe are very low. Men in the woods are paid about sixty cents a day. Much of the work, however, is done by women and boys, the former receiving forty cents, the latter twenty-five cents, for a day of twelve hours.

*In the Adirondacks spruce is worth on the stump about four dollars, and beech about two dollars per 1,000 feet. In New York oak is worth about fourteen dollars per 1,000 feet.

The Good Roads.

The good roads are also a factor to be considered. Since the forests are to be lumbered perpetually, the roads are made for permanency, consisting often of stone, laid with much expense, and not infrequently macadamized. In the Spessart, four dollars and fifty cents a cubic meter for stone laid at the roadside and broken, is not considered an exorbitant price. In 1903 Saxony spent \$175,000 on forest roads. The roads are properly graded, and some of them have along their sides, at intervals of about fifty feet, large stones set on edge, which serve as a guide in winter. On much traveled roads these stones are often painted white to serve as a guide at night. At each important crossroad a guidepost is placed so that the traveler can easily find his way. Occasionally, in an ever-green forest, hardwood trees are planted along the "chaussée," the foliage in autumn contrasting charmingly with the dark green of the conifers. With roads thus carefully made and kept constantly in good condition the hauling of timber is an easy matter. In the dukedom of Brunswick, Germany, the building of a system of good roads increased the income from the forest management by twenty per cent.

How Timber Is Transported.

Timber is not skidded. It is drawn to the roads from the woods, or the field where it is felled, in about the same way as it is snaked to the skidway in America. The small material is frequently brought out on sleds, even in summer. Tramways have recently become quite common for this purpose. Occasionally the tramway is constructed with only one rail, especially where ledges occur along its course which are too narrow to permit a two-rail track. The car for such a track has, besides the wheel that runs on the rail, a wheel at each side, either of which is made to run on the ground by the weight of a man who stands on the rear end of the car and moves from side to side as necessity requires.

Felled timber is peeled of bark, especially when cut in the summer. This is generally done before it is hauled out of the woods. Pulp-wood is sometimes taken to the railroad with the bark on, and then peeled close to where it is to be loaded upon the cars. This method saves expense in transportation, prevents damage by insects, and preserves the white color of the wood. Occasionally, among the peeled logs, two or three are left with the bark on as a trap to catch the insects. These are burned when they become much infested.

Logs are usually hauled on trucks drawn by oxen or horses, in France the horses being hitched tandem. In Italy, high-wheeled carts are used, with the long



G. W. MANCHOT, PHOTO.

HAULING TIMBER IN THE SCHWARZWALD.

AT GEROLDSAU, NEAR BADEN-BADEN.



A. KNECHTEL, PHOTO.

FOREST RAILWAY, WITH ONE RAIL ONLY, FOR HAULING OUT FIREWOOD AND MINOR PRODUCTS.

IN THE MARIEN-TAL, THURINGIA.

timbers suspended below the axles. For great distances the streams were formerly much used, and many timber-rafts still float down the larger rivers, the Elbe and the Rhine, for instance. The railroads are penetrating the forests, however, and now transport large quantities of wood that was formerly put into the streams.

Along the Enz river, in the Black Forest, are located some of the largest sawmills in Germany. The stock for these mills comes mostly on the railroad in long, large logs, much of it being brought from Württemberg and Swabia. For each load of logs, two cars are necessary. In a railroad train, every three of these couples must be followed by a protective car laden either with freight or passengers, and weighing, with its load, not less than 4,500 pounds.

The Sawmills.

The sawmills are mostly small, occasionally with the dwelling-house of the mill owner under the same roof. They are, for the most part, run by water, the streams of the forests having a constant flow since the hills are kept wooded. The old "up-and-down" saw is still in common use, though many of the better mills are equipped with circular saws, band saws, or gangs with eight or ten saws in a frame. However, things move slowly in a European mill. There is a noticeable lack of the buzz and activity that characterizes the American mill, with its "flippers," "niggers," "shot-gun feed," and "hog." A large mill in Europe will cut about 25,000 feet, board measure, per day of ten hours; a fair-sized American mill, 100,000 feet. But the small mill of Europe is permanent, being supported by perpetual crops of timber from the cultivated forests of the neighborhood. The large American mill is only temporary, as it depends for its existence upon a single crop that is being consumed with amazing rapidity, and is not being restored.

In piling lumber in the mill yard it is a common custom to put together the boards of each log in the same relation as they held before the log was sawed, small strips being placed between the boards to allow the lumber to dry. Thus, one part of the mill yard has the sawlogs, another part the sawed logs. Customers can then see that they get all the lumber their logs will afford. The logs are recognized, each by a number previously marked upon one end of the log, and recorded in the notebook of the customer. Sometimes, in order that the number may not be effaced, the log is not sawed entirely through, but remains intact at one end for about half an inch. In the larger mills, however, it is assorted and piled as in America, at least for the commercial trade.

Forest Fires.

Since dead timber is not left in the forests, there is but little loss from fires. In Saxony, with 435,000 acres of forest, the loss from this cause is rarely more than \$300 per annum. Württemberg, with 418,904 acres of forest, has an annual loss of about \$650. The Duchy of Baden, with 240,000 acres, had only 99 acres burned in nine years.*

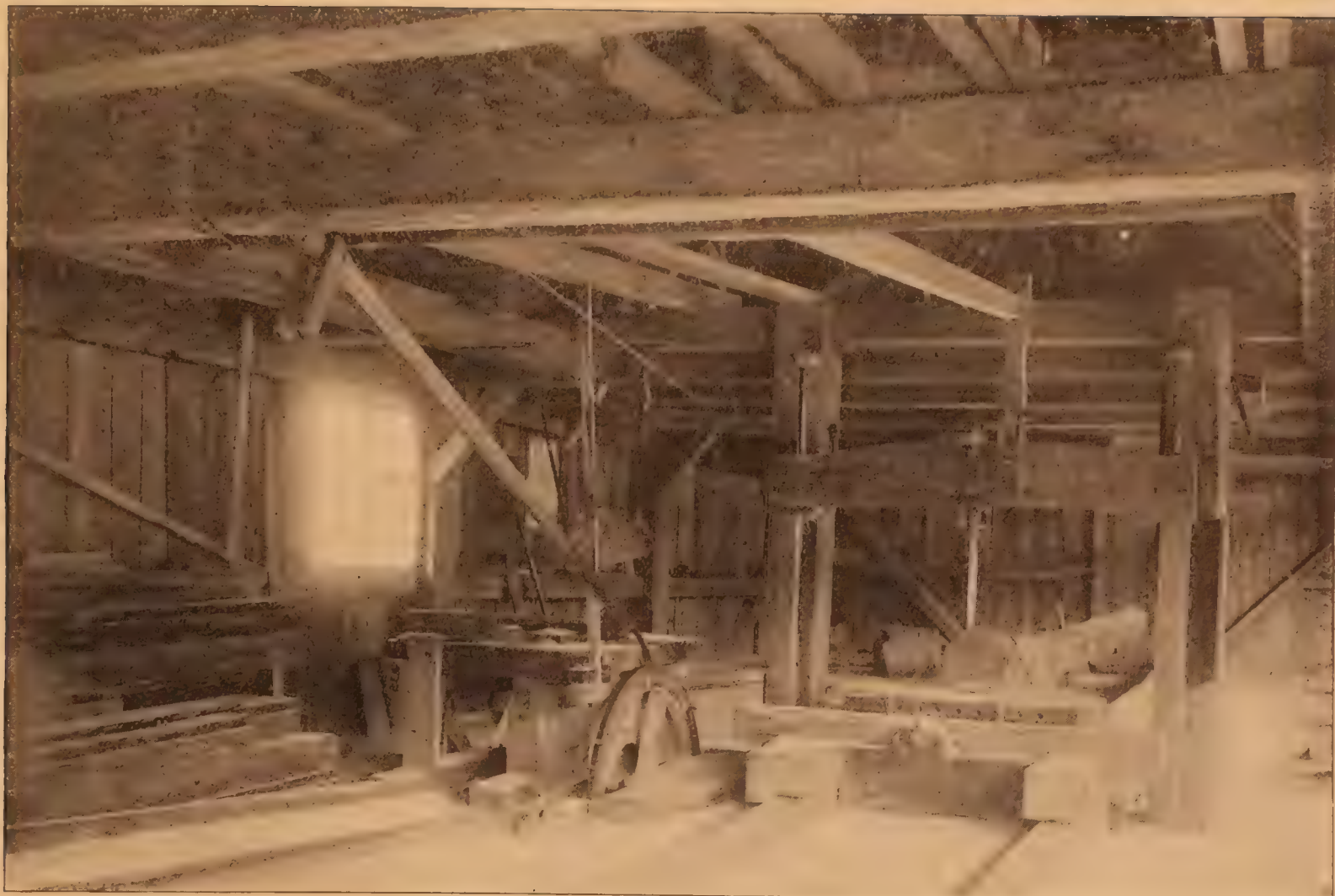
The fires are started mostly by careless smokers and workmen. Locomotives do slight damage, causing, perhaps, not more than ten per cent of the fires. In Württemberg, from 1887 to 1897, there was a total of 120 fires, only eight caused by sparks from locomotives, and among these only one causing considerable damage (\$3,570).† Along the railroads, however, precautionary measures receive considerable attention. In many places along the forested side of the track there is a ditch about eight feet wide, which is kept free of all vegetable growth. Frequently a strip of forest about a rod wide, running parallel with the railroad is specially prepared in the following manner: A path along the edge of the woods is spaded about four feet wide. In the forest, about a rod from this, and running parallel with it, a second path is made. Cross-paths joining these two are made at intervals of a rod. These paths are at all times kept free of vegetation, and the ground in the strip is raked free of leaves and twigs. Sometimes a double strip is made, two rods wide, with three paths parallel with the railroad, and cross-paths as in the single strip. Frequently, the white birch is the tree grown on these strips, but a general opinion prevails that the spruce gives equally good protection with less trouble from the fallen leaves. Occasionally, along a pine forest, can be seen a protecting strip of birch without the spaded paths.

The forest may belong to a state, a city or other community, a charitable institution, a corporation, or a private individual. The railroads are required to pay in full all damages caused by them to the forest. But, since the railroads are nearly all government property, claims against them are easily adjusted. Locomotives are provided with spark arresters. The right-of-way is sixty-six feet wide and is kept clean.

The forest itself is intersected more or less with fire lanes, each two or three

* For further figures in regard to forest fires, see the Tenth Annual Report of Gen. C. C. Andrews, Chief Firewarden of Minnesota. The publication also contains much other useful information in regard to European forestry.

† U. S. Consular Reports, 1897. Vol. LV, page 64. "Forestry in Württemberg," W. Hahn.



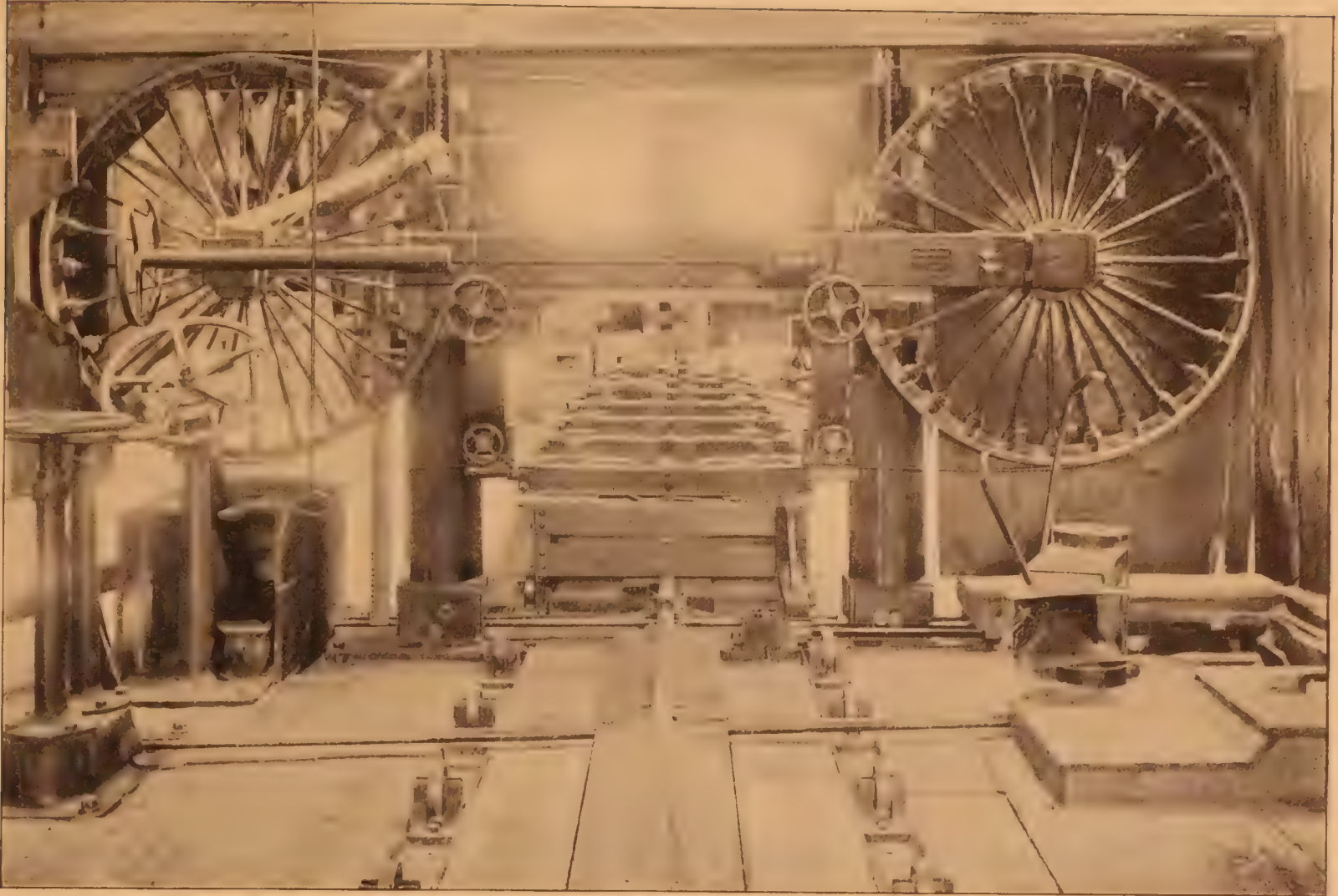
A. KNECHTEL, PHOTO.

INTERIOR OF AN OLD SAWMILL.
HÖLLENTHAL, BLACK FOREST.



A. KNECHTEL, PHOTO.

GANG WITH SIXTEEN SAWS: LOG SAWED ENTIRE.
NEAR ANNABERG, ERZGEBIRGE, SAXONY.



A. MOSER, PHOTO.

HORIZONTAL BAND SAW.
CANTON OF ZURICH, SWITZERLAND.



A. KNECHTEL, PHOTO.

LOG YARD OF A GERMAN SAWMILL.
AT HASSERODE, IN THE HARTZ MOUNTAINS.

rods wide. These are kept free of all inflammable material. In a coniferous forest the trees stand close together, facilitating, in a dry time, the progress of a top fire. These fire lanes make a break in the continuity of the crown-cover and give an opportunity to check the flames.

The small loss from forest fires is due, in a large measure, to the fact that villages are numerous in the forests, and hence fire fighters are easily obtainable. The European forests are not much troubled with trespassers. The woods are, as a usual thing, well patrolled and the property limits are plainly marked. Where watercourses, rocks, or other natural boundaries are wanting, the lines are marked by artificial signs, such as heaps of earth, stones, or iron stakes. This leaves no chance for the American excuse of ignorance concerning the line.

Injuries and Diseases.

To describe all the injuries inflicted upon the woodlands by domestic and game animals, rodents, insects and fungi, would cover many times more pages than can be given to this article. Besides, one hears, in Europe, general complaint concerning only the deer, snow-press or snow-break, a few insects, and a few fungi.

The deer are numerous and injure the trees by biting off the buds and young shoots, often killing young plants, and crippling and stunting older ones. They also injure saplings or poles by barking them in rubbing off upon them the velvet from their antlers in early summer. They also tread down the seedling growth, and devour acorns and beechnuts. The young trees are sometimes protected by smearing the tips with a mixture of beef blood and manure, the deer refusing then to eat them. Reducing the number of the deer by shooting them seems, however, to be the only general remedy.

Conifers are much damaged by snow, which at times falls in wet, large flakes and hangs together as a thick, white mantle upon the crowns of the trees. When the snow freezes upon the trees the danger is much increased, as it cannot then be shaken off by the wind and further accumulations are facilitated. Conifers from twenty to sixty years of age, and growing at an altitude of from 1,600 to 2,500 feet, receive the most injury. As the broad-leaf trees are without foliage in winter, they are damaged only by an unusually early or late fall of snow. The Scotch pine is brittle and suffers chiefly by having its branches broken off. The spruce and fir are similarly injured, but, being more pliable, they are often bent to the ground and sometimes have their roots torn out of the soil.

The Scotch pine is often much injured by moths and beetles. Among the former the large Pine Moth (*Bombyx pini*) does perhaps the most damage. The caterpillars of this moth appear in August, eat upon the needles of the pine, go into winter quarters under the surface of the soil, come forth again in March, reascend the trees and feed upon the foliage till about the end of June. In bad years the trees are defoliated, and even the buds are devoured, in which latter case the crop is killed.

The Pine-shoot Tortrix (*Tortrix buoliana*) is also troublesome. The eggs of this moth are laid in the terminal buds, which, in spring, are eaten and hollowed out by the caterpillars. The trees are not usually killed, but are made very crooked, as some one of the lateral shoots then becomes the leader.

The Scotch pine is subject also to fungus diseases, which soon reduce the wood to a quality fit only for firewood. One of the worst of these (*Trametes radiciperda*) causes a red-rot, attacking the roots and extending upward into the stems.

Another parasite (*Trametes pini*) is very abundant in the pine woods, causing a so-called bark-shake, ring-shake or heart-shake. The injury begins at a wound where, for instance, a branch has been broken off. It grows through the entire tree, manifesting itself on the outside by a brown, bracket-like growth.

The fir is chiefly injured by a fungus disease called "Krebs" (*Acidium elatinum*) which shows itself in a swelling that often entirely encircles the tree. The "Witches Broom," a thick, distorted growth of the branches, is caused by the same fungus.

The spruce is often injured during the first few years of its growth by a beetle called Rüsselkäfer (*Hylobius abietis*), the larvæ of which eat the bark, often removing it entirely around the tree. Various devices are in use for collecting the beetles, the following being perhaps the most practicable: Pieces of bark about eight or ten inches square are taken from trees and laid fresh on the ground, the cambium side down. The insects come at night, go beneath the bark to get the cambium and are caught and destroyed by the workmen early in the morning.

The Nun Moth (*Liparis monacha*), so called on account of its plain black and white colors, does great damage to the spruce. It also attacks pine, beech, oak, birch and nearly all other species of trees. The damage to the broad-leaf trees is, however, seldom fatal. The eggs are laid in July or August, on the stem, beneath the scales of the bark. The caterpillars hatch out in April or May of the next year, ascend the tree and commence feeding on the foliage. They devour entirely the needles of the spruce, but bite off the pine needles at about the middle and eat only the lower portion.



A. KNECHTEL, PHOTO.

FIRE LANE.

BISMARCK FOREST, FRIEDRICHSRUH, NORTH PRUSSIA.



A. KNECHTEL, PHOTO.

CUTTING FIREWOOD.

CITY FOREST OF GRABOW, MECKLENBURG, NORTH GERMANY.

The destruction of insects and fungi is attended with great difficulties and is not very satisfactory. Preventive measures, however, receive great attention. Diseased trees and rotting wood are carefully removed from the forest, as these favor the spread of fungi and offer breeding-places for the insects. Stumps are often taken out of the ground on this account and sold by the forester, even though they may bring no profit.

Extent and Location of the Forests.

The forests of Europe occupy land that is unfit for agriculture—mountains where the climate is severe, hills where the ground is rocky, plains where the soil is sterile. In some of them the wood supply is only a secondary consideration, the forest being kept principally as a game preserve, a tourist resort, or because it exercises certain protective functions. In the Spessart there is a forest devoted largely to raising wild boars. Another, visited by many tourists, has splendid drives, with species of trees planted for their esthetic effect.

The following brief table gives an idea of the extent of area devoted to forests in several countries of Europe. The figures are taken from "Forstwissenschaft," by Dr. Adam Schwappach:

TABLE OF FOREST AREAS IN EUROPE.

COUNTRY.	Forest area, in acres.	Percentage of total land area in forests.	Percentage of forest belonging to the State and Crown.
Germany	34,981,067	25.8	33.3
Austria	24,456,272	30.7	7.3
Hungary	22,958,977	35.2	16.1
France	20,992,827	15.9	12.9
Russia in Europe	478,845,175	38.3	60.3
Finland	50,971,125	56.0	71.1
Norway	19,405,250	31.5	12.5
Sweden	43,395,430	34.1	19.9
Italy	10,231,840	14.2	4.0
Switzerland	2,053,630	20.0	4.2
Total forest area	708,291,593	31.5	

These countries are constantly increasing their forest areas. From 1872 to 1892, France acquired 300,000 acres; Prussia, 280,000 acres. Austria purchased 60,000 acres in 1886, 230,000 in 1888 and 210,000 in 1891.

The mountain slopes are covered mostly with spruce and fir, the pines and broad-leaf trees occupying the lower land. Germany has 23,000,000 acres covered with conifers and 12,000,000 acres with broad-leaf trees. Of the conifers 8,000,000 acres are spruce and fir and 15,000,000 acres pine. The broad-leaf trees are mostly beech and oak. Sandy soil, not strong enough for the growth of other species, is planted with pine. The following table shows the distribution of species according to the quality of the soil:

SOIL TABLE.

SPECIES.	CONIFERS.						BROAD-LEAF TREES.												
	Fir.	Larch.	Spruce.	American Jack Pine.	American White Pine.	Scotch Pine.	European Alder.	Speckled Alder.	Birch.	Hornbeam.	Beech.	Ash.	Cottonwood.	White Poplar.	COMMON OAK.		American Red Oak.	American Locust.	Elm.
															Peduncled.	Sessile-Flowered.			
LOWLANDS:																			
Light sand				+	-	+			-		-							+	
Loamy sand			-			+		+	+	+		+				+			+
Clay loam		-	-			-	-	+		-	-	+	+	+	+	+	+	-	-
Clay bottom land		-	-		+		+	+	+	+		+	+	+	+	+	+		+
Rich meadow land					-		+	-	+	+	-	+	+	+	+	+			
Boggy sand				-		-	+		+	-	-	-							-
MEDIUM ALTITUDES:																			
Light sand	-	-		+		-		-	-		-	-						-	-
Loamy sand			-	+	+	+	-	+		+		-	+					+	+
Clay loam	+	-	-		+		-			-		+	-	-	-	-	-	+	-
Moist, rich clay	-	-	+		-		-	+	+	+	+	+	+	-	-	-	+		+
Boggy sand	-	-	-	-			+		+	-	-	-				-			-
HIGH ALTITUDES:																			
Lime soil	-	+	+		-	-	-	+	-	+	+	-				-	+		
Limey drift	-	-				-		-	-										
Slopes, gneiss rock	-	+	+				-	-	-	-	-	-							
Slopes, lime rock		+	-					+	-	+	+	-							
High plains and meadows			-					-											

SOIL TABLE.—Signs: + Indicates culture with success. | Indicates culture with partial success; the species serves for the protection or improvement of the soil. - Indicates culture with little success; the species suffers.

History of Forestry.

The art of forestry may be said to have had its origin among the Germanic tribes about 1,000 years ago, although Plato, 400 years before the coming of Christ, deplored the destruction of the forests of Greece.

The first comprehensive code of forest laws is attributed to Canute, a famous King of England, Denmark and Norway, who reigned from 1014 till 1035. These laws defined the forest as a hunting-ground for the King. The trees were considered as only a shelter and covert for the game. Later, under Norman rule, the laws were much modified and became very objectionable to the people. It is said that their severity was one of the causes which brought about the passing of the Magna Charta, with which was associated the Charta Foresta.*

Until quite recent times the forest was considered as only a hunting-ground. The following statement appears in Manwood's "Forest Laws," published in 1598: "A forest is a certain territory of woody grounds and fruitful pastures, privileged for wild beasts and foules of forest, chase and warren, to rest and abide in, in the safe protection of the King for his princely delight and pleasure." Blackstone's definition of a forest reads thus: "Forests are waste grounds belonging to the King, replenished with all manner of chase or venery, which are under the King's protection for the sake of his recreation and delight."†

The artificial reforestation of waste lands was begun by the city of Nuremberg, Bavaria, in 1368, by the planting of pine, a practice soon imitated by many communities in southwestern Germany.

About the middle of the seventeenth century, forest exploitation was carried on in Europe much in the same way as it has been carried on in America to the present day, the forests there at that time having come to be valued for their wood more than for the shelter they afforded to the game. There was but little regard for the conservation of the forest. The question as to whether trees should be taken from the woods or left therein was simply a market question. The trees that would bring in the market a price sufficient to leave a margin after paying the cost of removal were taken, the rest were left. This method is called, in French, *jardinage*, or gardening, as the procedure is similar to that of a gardener gathering vegetables.

Under this system there was a reckless destruction of forests, and the disastrous consequences began to be apparent. Colbert, the minister of Louis XIV, clearly

* See English Estate Forestry, page 8, by A. C. Forbes.

† See Forests in England, by J. C. Brown.

saw the peril of such treatment of the woodlands and gave expression to his fears in the oft-quoted words: *France perira faute des bois!*—"France will perish through lack of woods." Agitation for an improvement upon the method of forest exploitation became very active and resulted in the French ordinance of 1669* which established a system called *La Methode à tire et aire*. By this method the forest was divided into lots, to each of which, in succession, ordinary fellings were confined, trees being left properly distributed for the dispersion of seed. Thus, for example, a timber forest was divided into one hundred and twenty lots, and each year only one lot was lumbered and then left to restore itself from the seed trees for one hundred and twenty years.

This system was adopted in Germany and was practiced in both countries until about the middle of the eighteenth century. It was then observed that the forests exploited under this method were not well restored. The conifers did not seed sufficiently, and the beech failed to give a satisfactory growth, either of seedlings or of shoots from the stumps left in the ground.

The French, though recognizing the evils, were slow to attempt a remedy; but the Germans, toward the end of the reign of Frederick the Great, issued an ordinance which confined the fellings upon the different lots to the removal of mature trees upward of 70 or 80 years of age, and the bad wood. But even this mode of exploitation failed of the desired result—a sustained yield.

The modern system of forestry was devised by Hartig, who, in 1791, published a treatise entitled, "Instruction in Forest Economy for Foresters," which contained his views on the exploitation and reproduction of the forest. Cotta, who, in 1817, published a work entitled, "Instruction in the Culture of Woods," carried forward the work of Hartig. It is to Cotta that the credit is due for modern forest economy in its complete development.

Status of the Forester.

Forestry in Europe is now a well-established profession for which the candidate must prepare himself thoroughly. He must learn the science in a forestry school, where the course of study requires as much labor as that for any other learned profession. After graduation he must practice the art for several years under a forest master, an officer who has charge of a range. He takes, first, a position called in Germany "Forstreferender," at a salary of about 1,200 marks. In two or three years he is advanced to that of "Forstassessor," at 3,000 marks. With

* See French Forest Ordinance of 1669, by J. C. Brown.



A. KNECHTEL, PHOTO.

HOUSE OF AN OBERFÖRSTER.

IN THE HARTZ, GERMANY.



A. KNECHTEL, PHOTO.

MONUMENT IN THE WOODS TO THE MEMORY OF A FORESTER.

MECKLENBURG, GERMANY.

successful service he may then be promoted to the position of "Oberförster," with a salary of 4,500 marks.

The Oberförster is held in very high esteem in his community. He is usually a man of fine physique and sterling qualities. His dwelling is called the "Oberförsterei." It is a fine, commodious building, erected specially to suit his needs. A part of it is occupied by his family, and part is fitted up as offices for the transaction of forestry business. The Germans have a beautiful and impressive way of doing honor to an Oberförster, after his life's labors are over, in erecting to his memory a monument in the heart of the forest which he has managed.

Revenues.

The business side of forestry is always kept very prominently in view. The forest must be made to yield a profit on the investment, especially if it is cultivated for its wood supply. It rarely fails in this respect. The following table was compiled by Ernest L. Harris, United States Consular Agent at Eibenstock. It gives statistics for the twelve principal forest districts into which the kingdom of Saxony is divided. The figures were taken from the "Forest Year Book," published at Tharandt in 1898. The forests covered in all, at that time, 434,896 acres:

PRINCIPAL DISTRICTS.	Income.	Expenses.	Value of forests.	Dividends, per cent.
Dresden	\$112,312 70	\$57,758 95	\$3,234,253 00	1.69
Moritzburg	89,929 85	48,044 42	3,491,388 00	1.2
Schandau	353,335 36	127,773 11	10,066,185 00	2.24
Grillenbourg	200,421 70	74,296 10	5,057,721 00	2.45
Tharandt	13,727 52	7,133 81	396,184 00	1.29
Barenfels	334,701 10	95,362 12	7,274,692 00	3.3
Marienberg	436,286 03	121,016 12	11,283,580 00	2.79
Schwarzenberg	535,287 01	135,471 65	10,257,204 00	3.9
Eibenstock	384,646 04	112,691 90	8,779,320 00	3.13
Auerbach	361,884 86	141,871 72	7,364,981 00	2.99
Zschopau	206,383 03	85,725 15	5,541,759 00	2.18
Grimma	218,061 22	88,219 80	6,791,132 00	1.94
Totals	\$3,246,796 42	\$1,005,364 85	\$79,538,399 00	*2.71

* Average. The net profit was \$2,241,611.57. The net profit per acre was \$5.15.

A net revenue of three per cent may be considered a low rate of interest, but one should bear in mind that the state must have wood; that the forest occupies non-agricultural land; that the investment is continuous; and that the risk is not great. Relative to this question is also the fact that in Germany the state is considered under moral obligation to furnish employment to its citizens. "About \$40,000,000 is paid every year in Germany for the creation and preservation of forests; 200,000 families are supported from them, while something like 3,000,000 persons find employment in the various wood industries of the empire. The total revenue from the forests amounts to \$14,500,000, and the current expenses, \$8,500,000."*

Where the market conditions are very favorable, the net revenue may be considerably greater than that indicated by the table. The canton of Zurich in Switzerland gives a net receipt per annum of 91.06 francs per hectare of forest, which is equivalent to \$7.28 per acre. About half of this comes from the sale of brush and small wood from thinnings.

Forestry Prospects in America.

That America will be compelled to practice forestry very extensively is self-evident. It will be a long time, however, before the results will be as satisfactory as they are in Europe. The factors upon which the growth of trees depend are about the same here as there. Other conditions, however, are widely different. There, the forests are comparatively small, broken, densely populated, and the roads are fine. Our forests are very large, compact, without population, and without roads. There, wages are very low and the market for wood is high; here, wages are high and the market for wood is low. There, the limbs, tops and brush-wood are all utilized; here, they are practically without market value. There, the woods are clean and free from the danger of fire; here, the woods are a veritable fire-trap. Not only are the tops and limbs left in the forest here, but they are thrown into heaps as if the woods were made ready to be burned. There, since the woods are clean, the conditions for the spread of insects and fungi are reduced; here, the abundance of rotting wood in the forest offers to the insects good breeding-places, and to the fungi favorable conditions for their growth.

In America there are also certain notions of government which will hinder the achievement of results such as have crowned the efforts of European foresters. In Europe it is held that the forests are all national property; not state forests

*Garden and Forest, November, 1892, p. 576.



A. KNECHTEL, PHOTO.

RAFT OF LONG TIMBER, ON THE RHINE.

AT BONN, GERMANY.



A. MOSER, PHOTO.

PLANT FOR IMPREGNATING WOOD WITH PRESERVATIVE SOLUTION. TREATMENT OF TELEGRAPH POLES.

SIHLWALD, SWITZERLAND.

alone, but all forests. Hence many private forests are brought under government management. It is considered that each generation has a right to the forest products, but the forest itself must be left to the succeeding generation in as good condition as it was found. In France no clearing is permitted in private forests without the sanction of the government authorities. In Würtemberg, Germany, clearing on private property is under state control. In Russia a law provides for the control and management of the forests of individuals where the public welfare seems to demand it, and the cutting down of such forests is prohibited when it might endanger the best interests of the whole community.

It will be a long time before this tenet will be accepted in America. In this country, at least in New York State, it seems to be the policy of the State to permit wholesale destruction of private forests and to deny to the people forever the use of the products of the State forest. There is a clause in the Constitution of the State of New York which forbids the removal of timber, dead or alive, from State lands. It reads thus: "The lands of the State, now owned or hereafter acquired, constituting the forest preserve as now fixed by law, shall be forever kept as wild forest lands. They shall not be leased, sold, or exchanged, or be taken by any corporation, public or private, *nor shall the timber thereon be sold, removed or destroyed.*"

Since the people of New York are denied the use of the wood on State land, it is of prime importance that the culture of forests on private land should be encouraged. Since the State is to depend wholly upon the private forests for its home timber product, private forestry should, under favorable conditions, become as profitable here as anywhere else in America. But in this State private forestry is confronted with unfavorable conditions. Our rate of taxation gives but little chance for profit. Forest lands in New York, public and private, have an average assessed valuation of two dollars, and bear a State tax of seven cents per acre. Private forestry cannot be practiced under such a high rate of taxation. If a forest is planted on denuded land, at the end of thirty years—about the time when the first thinning will be made—the taxes, with accumulated interest, will have amounted to more than the sale value of the timber.*

In France and Switzerland reforested land is released from taxes for thirty years. In Italy, instead of this, the forest department contributes to associations and private owners three fifths of the total expense of the work of reforestation

* See Economics of Forestry, p. 251, by B. Fernow, LL. D. Also, Fifth Annual Report of the New York State Forest, Fish and Game Commission, p. 397; Forest Taxation, by C. A. Schenck, Ph. D.

upon the condition that the plans for the work, prepared by the department, be followed, and the work be done in the specified time.

It is difficult for a forester to see good reason in the constitutional clause which prohibits State land from being used to provide the people with wood. Its advocates cry: "The forest must be preserved!" But this law compels conditions under which the forest may be destroyed by fire, insects and fungi; and, by the annual decay and loss of unharvested material, the forest product is allowed to go to waste. "Ah, but the forest must be left to protect the headwaters of our streams!" Aye, but the forest is not permitted to be managed so that it can best subserve this purpose. A cultivated forest gives much better protection than a wild, ragged woods, with many large areas along the streams entirely bare. "But we are afraid of collusion between the lumbermen and the State officials, and we think it better to endure the ills we have, than fly to others that we know not of." This is an unjust and unnecessary arraignment of the officials who have been appointed to look after the forests. If the people of the State of New York are so degenerate that they cannot find men of integrity to take care of their public affairs, it is immaterial whether the forests are preserved or not.





A. FRANCHI, PHOTO.

ITALIAN FORESTERS.

OFFICERS OF THE FORESTRY DEPARTMENT, FLORENCE, ITALY.

Forest Nurseries and Nursery Methods in Europe

BY WILLIAM F. FOX.

Introductory.

IN the management of American forests the time has come when it would seem evident to all interested in the work that the future timber supply in many localities is dependent on reforestation. But natural reforestation is unsatisfactory from the forester's point of view. In results it falls short, by far, of the maximum in quantity and quality of merchantable timber which a given area can be made to yield through proper methods of silvicultural work.

The highly satisfactory results attained from planted forests in Europe, where this practice has been followed for two centuries or more, justifies clearly the adoption of this system in America. The New Forest in England was "afforested" by order of William the Conqueror, in 1079, and since then reforestation has been practiced from time to time in European countries, until cultivated forests are now the rule rather than the exception. Throughout Germany, France, Belgium and Italy most of the wooded areas show high forests of a density and regularity that indicate plainly their artificial growth. For these and other reasons the planting of forests is engaging the attention of American foresters to-day. It is no new idea.

A planted forest, like the primitive one, is grown from seed, but in the former the dissemination is under intelligent control. This may be done by broadcast sowing, by the seed-spot method, or by the intermediate process of raising small seedlings in garden or nursery beds; and, large areas of trees are propagated from wind-sown seeds, skilfully directed and managed.

Broadcast sowing may be a desirable method under certain conditions—where economy is necessary, where a supply of seedling plants cannot be obtained conveniently, or where a rocky, uneven surface, covered with a scrubby growth, compels its use. But it has the disadvantages of uncertainty, irregularity and the subsequent expense of filling in the blanks where seeds failed to germinate. As the planting of seedlings at regular intervals gives the forester better control

of his future work, this plan is in general use abroad. It necessitates, however, the establishment of nurseries for the propagation of the young plants.

The management of tree nurseries, in connection with forest plantations, has been carried on for so many years in Europe that the American forester who is about to engage in this branch of silvicultural work will find there an ample field in which to study and gain the information available for similar efforts. These nurseries will be found in most of the forest regions abroad—the *baumschule* in Germany, the *pepinière* in France, and the *piantonario* in Italy. The object of these pages is to describe briefly, but as plainly as possible, the technical methods employed in the forest nurseries of various European countries.

For this purpose the descriptions are confined to certain ones in which the construction and management are fairly typical of the others in that particular country. To attempt more would involve needless repetition and unnecessarily extend the scope and province of this article.

Italy.

We have heard so much of German forestry and its superior methods that our American foresters, when they go abroad for study and information, are too apt to devote their time exclusively to travel within Germany. It would be well if, when not limited as to time or expense, they were to extend their observations to some of the other continental forests and nurseries. But few of our foresters seem to have paid any attention to Italy. This may be due to the small percentage of woodlands in that country. But the Italian Government is steadily increasing its forest areas, and is conducting silvicultural operations of a high order.

The nurseries have an annual output of about 9,000,000 plants, and new plantations of large areas are made each year. The surplus seedlings, or transplants, not necessary for fieldwork are distributed free to persons who may need them in reforesting private lands.

The location, area and product of the various nurseries maintained by the Italian Government are as follows:

PROVINCE.	Name of the forest nursery.	Area in hectares.*	Yearly expenditure for maintenance.	Number of plants produced.
			Francs.	
Firenze	Vallombrosa	5.4538	6,538.25	1,000,000
Arezzo	Camaldoli	7.3354	6,203.00	800,000
Firenze	Boscolungo	2.9605	2,978.40	600,000
Belluno	Pian Spini	2.9836	3,071.76	1,200,000
Bergamo	Pradoni	1.6022	669.18	140,000

PROVINCE.	Name of the forest nursery.	Area in hectares.*	Yearly expenditure for maintenance.	Number of plants produced.
			Francs.	
Brescia	Begotta . . . . .	.2000	250.00	20,000
Cagliari	Aie, Maitoppi	1.8000	883.42	110,000
Caserta	Bandio	1.1936	276.16	100,000
Chieti	Martice	2.0479	1,509.48	300,000
Cosenza	Migliano	10.6900	3,363.93	600,000
Foggia	Giacomelli	1.0000	680.40	100,000
Genova	Trincata	1.2000	960.31	125,000
Grosseto	Follonica	4.0107	4,235.00	2,500,000
Macerata	San Giuseppe	1.5000	859.41	35,000
Novara	Aldec	3.8000	2,771.39	500,000
Palermo	Lavatoio	4.2000	2,504.49	400,000
Potenza	Vigna . . . . .	.9416	1,232.58	200,000
Sassari	Fraigada Pisanu	2.9994	743.40	130,000
Teramo	Buragna Paggiara	2.1814	1,298.00	118,000
Total . . . . .	. . . . .	58.1001	† 41,028.56	8,978,000

* A hectare is equal to 2.471 acres. † Or, \$7,795.43.

The above statement will give some idea of the large extent to which nurseries are used by European governments in their work of forest extension. In Germany and France the nurseries are much more numerous, owing to the larger area of forest, greater amount of timber cutting, and more extensive replanting.

The different species of trees propagated in these Italian nurseries are shown in the following list, which was kindly furnished by Inspector A Franchi, of the Forestry Department of Tuscany. The botanical designations, some of which are not used in this country, are as given in his list, and include some species which are rare in America:

- Silver fir
- Norway spruce
- Norway maple
- Sycamore maple
- European alder
- Speckled alder
- Chestnut
- Beech
- European ash
- Flowering ash
- Walnut
- Abies alba* Willd. (*Pinus picea* Linn.)
- Abies picea* Willd. (*Pinus abies* Linn.)
- Acer platanoides* Linn
- Acer pseudo-platanus* Linn.
- Alnus glutinosa* Gaertn.
- Alnus incana* Willd.
- Fagus castanea* Linn.
- Fagus sylvatica* Linn.
- Fraxinus excelsior* Linn.
- Fraxinus ornus* Linn.
- Juglans regia* Linn.

Larch	<i>Larix europaea</i> Dec.
Austrian pine	<i>Pinus austriaca</i> Reich.
Aleppo pine	<i>Pinus halepensis</i> Mill.
Corsican pine	<i>Pinus laricio</i> Poir.
Maritime pine	<i>Pinus pinaster</i> Ait.
Stone pine	<i>Pinus pinea</i> Linn
Scotch pine	<i>Pinus sylvestris</i> Linn.
Turkey oak	<i>Quercus cerris</i> Linn.
Holly or evergreen oak	<i>Quercus ilex</i> Linn.
English oak	<i>Quercus robur</i> Linn.
Siberian oak	<i>Quercus sessiliflora</i> Smith.
Cork oak	<i>Quercus suber</i> Linn.
Locust	<i>Robinia pseudo-acacia</i> Linn.
Basswood	<i>Tilia grandifolia</i> Smith.
English elm	<i>Ulmus campestris</i> Linn
Cypress	<i>Cupressus sempervirens</i> Linn.

Besides these forest nurseries there are those belonging to the societies for the replanting of forests, which receive subsidies from the government.

In the forest nurseries of the government additional native plants are cultivated as well as many foreign species. This year at Vallombrosa and Camaldoli the hard, or sugar, maple, *Acer saccharum* Marsh, will be cultivated from seeds furnished by the Forestry Department of New York.

At Camaldoli are some of the finest forests in Europe and a large nursery that, in size and cultural methods, will compare favorably with any. In most of the forest managements abroad a preference is given to small nurseries, of two acres or less, distributed so that each will be near the place where the seedlings will be planted. But at Camaldoli and Migliano large areas have been set apart for the propagation of seedling trees, and nearly all the public forests in Italy are supplied with young plants from these nurseries.

Camaldoli is in the Apenines, Province of Tuscany, and should not be confounded with the well-known place of that name near Naples. The former is easily reached by rail from Florence to Arezzo, thence by a branch railroad to Bibbiena, and thence by a drive of fifteen miles up the mountain pass to the old monastery, which has been converted by the government into a commodious, fashionable hotel.

The nursery, or *piantonaio*, at this place covers about thirteen acres, and has an altitude of 2,910 feet above the sea. The ground, which has a gentle slope to the northeast, is laid out in terraces so as to afford a level situation for the beds. The exposure is favorable, as it furnishes protection from late frosts and



A. FRANCHI, PHOTO.

NURSERY BEDS SHADED BY PLANTED TREES.

AT CAMALDOLI, PROVINCE OF TUSCANY, ITALY.



A. FRANCHI, PHOTO.

FOREST TREE NURSERY, ITALY.

WEEDING THE TRANSPLANT BEDS.

the rapid evaporation caused by south winds. Although not closely surrounded on all sides by high forests, there is a dense tree growth near by of various age classes. Owing to the altitude the natural soil is thin and poor, but the entire surface of the nursery is deeply covered with rich, friable earth composed largely of humus mixed with fertilizers. It has the appearance of a fine loam, with no black earth in it aside from that brought from the forest near by, and with enough clay and sand to give it a light color.

The beds for conifers are four feet wide, and of various lengths to suit the terraces, most of the beds being about thirty feet long. The greater part of the area is occupied by transplants, the seed beds needing comparatively small space.

In preparing the seed beds the seeds are planted in rows running across the beds. Formerly the seeds were sown broadcast in these beds, but this was abandoned because, as claimed by the forester in charge, by sowing in rows a much smaller amount of seed is used, the plants grow stronger and more even in size, are more easily weeded, and can be taken up with less work and injury to the roots.

The seedlings are taken from the seed beds when two years old and transplanted into the long beds, where they remain two or three years more. The transplants are then four or five years old, from twelve to eighteen inches high, and are ready for transfer to the grounds where the final planting for the future forest is made. The Italian foresters seldom use two-year-old seedlings in their fieldwork, preferring to wait for the four-year-old transplants on account of the advantages which the latter have in size, hardiness and better root system.

The plants are allowed to remain in the seed beds and transplant beds respectively as follows:

	Seed beds, years.	Transplant beds, years.	Removal to plantations at, years.
Spruce	2	3	5
Pine	2	2	4
Larch	2	2	4
Beech	2	1	3
Oak	2	1	3
Maple	2 to 3	2	4 to 5
Ash	2	1	3

The locusts are not transplanted in the nursery, but are taken from the seed beds when they are one year old and sent directly to the final plantation in the field.

The principal species growing in the Camaldoli nursery are: Silver fir, Norway spruce, longleaf pine, stone pine, Austrian pine, larch, beech, chestnut and sycamore maple.

No lath frames are used for shade. Protection from heat and drought is obtained when necessary by using pine brush, which is stuck into the ground on the sunny side of the beds. Screens of thatched straw are also used for the same purpose. Unlike other nurseries in Europe, small trees, twenty-five feet in height, or thereabouts, are standing at intervals of twenty feet throughout the greater part of the area, and their moving shade contributes to the refreshment and protection of the tender plants. An ample supply of water for irrigation is obtained from a small, artificial lake situated on the side of a hill just above the nursery.

The beds containing the transplants are kept in fine condition, all the plants being alive and green, and at even spaces in the rows. In some of the seed beds, however, bare spots may be seen at times, due to the destructive work of birds and squirrels. These blanks are also liable to occur after an unusually wet season, when the excessive moisture prevents to some extent the germination of the seeds.

The management of this nursery is in charge of a forestry official who is termed in Italy a "brigadier," a title somewhat puzzling to the foresters of other countries who may have served in the army. The work of preparing, planting and weeding the beds is done almost wholly by women at daily wages of about thirty cents each. One woman will set out about 1,200 seedlings in the transplant beds in a day, a day's work being counted as ten hours. Hence the cost of transplants is only one fourth of that in American nurseries.

Although somewhat of a digression, some mention seems pardonable here of the high forest about Camaldoli, which consists mostly of silver fir, unmixed with other woods. An hour's walk to Sacre Eremo takes one over a good road through the best of the timber, and affords an opportunity to see this famous species in a very heavy stand per acre. The trees are tall, straight and of large diameter, the dense growth indicating a possible yield of 70,000 feet, board measure, per acre, exclusive of the minor product. It was planted by the monks of Camaldoli over a century ago. Protection from fire is attained by patrols, and by watchmen posted in little cabins placed on surrounding hilltops and mountain peaks, from which they announce by signals the first appearance of smoke.

But on this tract, containing 3,600 acres, no cutting is seen. In 1901 the government enacted a law that no timber should be cut in a public forest within a certain distance of any summer resort. Perhaps the Italian legislators had read the restrictions in the forestry clause of the State Constitution of New York and

followed that. The proprietor of the hotel at Camaldoli seemed satisfied with this embargo on lumbering in his immediate vicinity, and lamented the fact that on an adjoining tract of 10,000 hectares (25,000 acres) a fine forest was being cleared away by its non-resident owner, a member of the Austrian nobility.

At Vallombrosa there is also a well-managed nursery belonging to the Forestry Institute at that place. It is in Tuscany, and the forester desirous of visiting this famous resort can go by rail from Florence to San Ellero, thence by a cog-wheel railway up the mountain, five miles, to Saltino. From the latter place it is only a few minutes' walk to the Hotel di Foresta and the "Istituto Forestale" at Vallombrosa. The nursery at this place is on the college grounds, with an altitude of 3,050 feet. The air is quite cool in summer, although the temperature may be excessively warm in the Tuscan valleys. A high elevation is a desirable condition for a forest nursery in this latitude.

The plot contains between one and two acres, and is situated on a level terrace surrounded by groves of forest trees. It is further sheltered from wind by the mountain which, densely covered with tall firs, slopes upward from the rear of the college buildings. The beds, planted mostly with silver fir, are in fine condition and divided by well-kept paths. Through years of repeated working the earth has been converted into a composite of rich soil in which there is a large admixture of forest humus. Some of the seedlings are taken up when two years old and sent to the plantation direct, without any previous transplanting. At times a free distribution of seedlings is made to farmers or landowners who may wish to reforest their denuded lands.

The nursery at Vallombrosa has a capacity of about 800,000 plants. In 1903 the species growing there, and the number of each, were as follows:

Silver fir	400,000
Norway spruce	30,000
European larch	10,000
Scotch pine	45,000
Corsican pine	32,000
Austrian pine	55,000
Beech	50,000
Chestnut	30,000
Norway maple	1,000
Sycamore maple	3,500
Locust	125,000
Other species	15,000
Total	<u>796,500</u>

Adjoining the nursery is an arboretum of several acres, mostly young trees. It contains many of our common American species, and to the forester from over the sea their familiar appearance is as welcome as the sight of old friends in a strange country. With the nursery and arboretum so close at hand, the students of the Forestry School have a fine opportunity for study and experience in this branch of silvics.

The dense forests and leafy conditions about Vallombrosa recall readily the literary quotation which has made this place so famous. The mountain slopes are thickly covered with fir and spruce, while near the college there are mixed woods of pine, locust, sycamore, mountain ash, white birch, chestnut, oak and poplar.

France.

In a country where the forests are managed mostly under the selection system and for the formation of coppice growth, as in France, the need of nurseries is consequently not so great as in one where clean cuttings are the rule. But whatever the method employed in reforestation, there is always a need for nursery-grown plants to fill the fall places. Hence there are *pepinières* in all the forest districts of France, some of which are absolutely perfect, not only in the technical methods employed but, also, in their attractive appearance.

One of the best, perhaps, of these may be found at Xettes, in the mountains of the French Vosges, near Gerardmer, Southeastern France. The plot is rectangular, 200 by 175 feet in size, and is inclosed by a rustic fence of neat design. It is surrounded closely on all sides by a dense, high forest of Norway spruce. The ground is nearly level, with a slight slope to the south, and has an altitude of 906 meters. The neat fence, clean paths, long, well-kept beds and pretty summer-house at one side well repay the long climb up the mountain from Gerardmer to find this secluded spot. The polite and attentive forester in charge wears a distinctive uniform, as is the case in all the government nurseries and forest reviers in Europe.

The entire area is devoted to the propagation of conifers—spruce and fir. To maintain the regular annual output nine seed beds are made, each about sixteen feet long, and inclosed in frames of wide boards placed on edge. These seed beds are covered with wire screens to protect them from the depredation of birds, and the screens are allowed to remain in place until August, or until the germination has advanced far enough to permit their removal.

The seedlings, when two years old, are transplanted into the long beds, where they remain two years more. The beds containing these transplants are four



A. KNECHTEL, PHOTO.

ROYAL FORESTRY INSTITUTE, VALLOMBROSA, ITALY.

THE LOCATION OF THE NURSERY APPEARS IN THE BACKGROUND.



H. G. STEVENS, PHOTO.

FOREST TREE NURSERY, AT XETTES.

IN THE FRENCH VOSGES.

feet wide and extend from the central walk to the side of the inclosure. The seedlings are placed in longitudinal rows, the latter being eight inches apart. The natural soil is a rich loam, mixed with humus, to which fertilizers have been added each year after the removal of the plants. As a result the four-year-old transplants when taken up are strong, thrifty, and from fourteen to eighteen inches in height, with a well-developed root system. Owing to the moist climate of the French Vosges, the great altitude and the close proximity of the forest, it is but seldom that the beds require any watering.

In other districts of France many of the nurseries are used in part, and in some instances entirely, for the propagation of broad-leaved species. In the Forest of Roumare, near Rouen, there is a *pepinière* which is stocked wholly with beech and oak. The beech is raised in seed beds, and then transplanted the same as is done with the conifers. The surrounding forests, however, are composed almost entirely of Scotch pine in pure stands. But it will be noticed throughout Northern France that, where a clean cutting occurs in a forest of the latter species, the ground is often left to reforest itself by natural dissemination.

There are several nurseries in the Forest of Rouvray—Department of the Seine—which are largely occupied by conifers, and in which the coniferous beds are frequently failures, owing to the depredation of rabbits. The foresters seemed to be unable to protect their inclosures from these pests. This is not surprising, for our American nurseries suffer serious injury at times from rodents. In the winter of 1904, after a fall of snow, one of the large forest-tree nurseries in Northern Illinois suffered a loss in white pine seedlings, caused by a swarm of field mice that cut off the stems close to the ground and inflicted damages estimated at \$5,000 before their presence was discovered.

Belgium.

Although Belgium has no place on the pages of our forestry textbooks, seventeen per cent of its area is well wooded. Its forests are of a high class that indicate an intelligent, intensive management, and the extensive formation of artificial ones is provided for by numerous nurseries.

In the great Forest of Soignes, at Groenendael, there is a *pepinière* of two acres, in which some interesting experiments are carried on at the present time in addition to the regular work. Some germinating beds are set apart for testing the relative efficacy of various materials for covering and protecting the tender yearlings. For this purpose trials are made of straw, dead leaves, moss, dried manure, humus, plain earth pressed down around each plant and plain earth applied

loosely. The results thus far are indeterminate, but seem to favor the use of dead leaves. Mention is made of this matter here, because each of these materials is in use in one place or another.

Other beds are devoted to experiments in deep, medium and shallow planting. Thus far the best results have been attained by a medium depth in which the root-collar was slightly covered. Experiments are also being made with reference to quick and delayed transplanting. As might be naturally expected, of the plants which were set out immediately all lived, while most of those which were delayed died sooner or later, according to the period of delay.

Interesting tests were made in trimming the roots of the two-year-old seedlings before transplanting. The thriftiest plants were obtained from those with uncut roots, a fact which seems to be at variance with the practice in some of the German nurseries.

Experiments were also made to ascertain the relative ability of seedlings to withstand the effects of sun and frost. While it was found that certain species were much more susceptible to injury in this respect than others, it also appeared that none were hardy enough to enable the forester to dispense entirely with some kind of protection.

In one part of the inclosure mustard plants are used to furnish shade for the tender species growing there, while some of the beds are covered with racks on which straw and brush are placed for protection from the sun. Many of the beds which had been planted with broad-leaved species contained young trees from six to eight feet high. The coniferous transplants were not over twelve inches in height, although four years old. In general, the minor details of the technical work is the same as that described later on in connection with the German nurseries.

This nursery, which is quite irregular in outline, is nearly level, with a slight slope to the south. Labels, neatly and plainly lettered, which can be read at a glance by one standing in the paths, are placed in each bed to show the species planted there. About one half of the area is occupied by broad-leaved plants, conspicuous among which are ash, beech, European chestnut and oak, the latter including the red, scarlet, English and pedunculate. This place is well worth visiting by any forester who may happen to be in its vicinity.

Adjoining the nursery, and separated by a fence, is an arboretum which was commenced in 1897, and hence the trees are small. But it already contains three hundred and twenty-one species, among which our native American trees are largely represented.



H. G. STEVENS, PHOTO.

FOREST TREE NURSERY, NEAR GERARDMER, FRANCE.

SEED BEDS COVERED WITH WIRE SCREENS TO PROTECT THE SEED FROM BIRDS.



H. G. STEVENS, PHOTO.

NORWAY SPRUCE, FOUR YEARS OLD, ONCE TRANSPLANTED.

BLACK FOREST.

Baden.

The extensive areas of planted woods in the Black Forest require a large number of nurseries for carrying on the work and for renewing the growth on lands as fast as the timber is removed. The well-managed *baumschule* at Geoldsau, near Baden-Baden, is a fair type of the small but numerous nurseries that may be found in the various districts of the Schwarzwald.

It has a square area of about half an acre, is located in a valley running east and west, and is situated about one hundred feet above the bottom of this valley on the southern slope. The forest approaches closely on three sides, while the precipitous slope on the opposite side of the valley is also well covered with tree growth. The nursery is surrounded by a paling fence, and a good road, used mostly for hauling timber, skirts the lower side of the inclosure.

The area contains one hundred and sixty-eight beds, each fifteen feet long and forty inches wide, separated by paths of convenient width. Two broad paths, four feet wide, one running through the middle up the slope and one at right angles to it, divide it into four equal parts. The main paths which separate the beds, and which run up the slope, are three feet wide, while the crosspaths at the ends of the beds are twelve inches wide.

The earth in the beds is a rich, sandy loam, prepared by mixing one load of ordinary forest soil with one of manure. This compost, until used, is piled just outside the fence, where it is allowed to remain undisturbed for three years. Three large heaps are necessarily kept on hand to furnish the proper annual supply.

The seed beds, eight in number, occupy only five per cent of the total area. These beds have a framework of boards around their edges, eight inches high, and are covered with wire screens of a small mesh, which are kept there until the seeds have germinated to protect them from the depredation of birds. The seeds are sown thickly and broadcast instead of in rows.

If the supply of plants from the seed beds is insufficient to stock the area set apart for transplants, the deficiency is made up by gathering two-year-old seedlings from the adjacent forest.

In 1903 the species growing in this nursery were:

- (1) Weisstanne, or silver fir, three and four years old.
- (2) Rottanne, or Norway spruce, four years old.
- (3) Sitka spruce (*Abies sitchensis*), three years old.
- (4) Forle, or Scotch pine, four years old.
- (5) Douglas spruce, four years old.

In addition there were, in a few beds which contained an assortment of species, some larch, sycamore, maple, Colorado spruce, white fir (*Abies concolor*) and *Larix leptolepis*.

The seedlings, as customary in most nurseries, are allowed to remain in the seed beds until they are two years old, when they are transplanted into other beds in the same nursery. These transplants are set out lengthwise of the beds in eight rows, fifty in each row, four inches apart in the row, and with a space of about six inches between the rows. This is closer than usual, but the forester claims that if the rows of transplants are set too far apart there is a tendency to fork, to the formation of two leaders, which, by the way, is one of the disadvantages urged by some against a plantation formed of nursery stock.

In transplanting a furrow is first made with a "hand-plough," which is drawn by one man and guided by another. Then a board with notches cut in the edge at distances corresponding to the spaces between the plants is placed on the bed with the notches over the furrow. The seedlings are then placed, one in each notch, the roots covered with prepared soil, and pressed into place. In some nurseries a planting board* is used which has half circles along the edge at the required spaces instead of V-shaped notches.

The longer roots of each seedling in the Geroldsau Nursery are clipped slightly to insure a greater amount of branching and a better root system in the transplants. This is deemed desirable by the forester, as it saves the expense of making a deeper hole when the final planting is made in the forest, and because there is less liability to loss in transplanting.

The transplants of the Weisstanne remain from three to four years in the beds, mostly four years, while the Rottanne are held in the transplant beds from two to three years, the length of time in each case depending on the height-growth attained. For the Rottanne a height of about twelve inches is deemed desirable in the transplant before removing it from the bed and taking it to the forest for final planting; but the Weisstanne, which is slower in growth, is removed from the nursery when eight or ten inches high.

At the corners and sides of each bed there are posts, about three feet high, which support long poles placed horizontally on top of the posts. If the post has no natural crotch in which the poles can rest, a hole is bored near the top of the stake and a round stick is inserted to furnish a bearing. From the first to the

*In New York we use this kind of board in our nursery work, but we set out our transplants here in rows running across the bed, which enables us to use a shorter board and to make the furrows by hand with a trowel pressed deeply into the soft earth. Furthermore, with rows placed this way a man sitting in the path can do the weeding more easily. Still, each way has its advantages, and, some disadvantages also.



G. W. MANCHOT, PHOTO.

SEED BED OF SCOTCH PINE, TWO YEARS OLD.

IN NURSERY AT GEROLDSAU, BADEN.



H. G. STEVENS, PHOTO.

BEDS OF FOUR-YEAR-OLD TRANSPLANTS, NORWAY SPRUCE.

IN NURSERY BELONGING TO A PRIVATE FOREST, GERMANY.

twentieth of May these horizontal poles are covered with brush to protect the transplants from the frost which is liable to occur in the valley.

The total number of transplants in this nursery, in 1903, was 65,000, of which 17,000 six-year-old Weisstanne were to be set out in plantations the following year. The Weisstanne formed the principal species raised in this plot, comprising ninety per cent of the plants. The Rottanne, or Norway spruce, occupied only five beds, or about three per cent of the area. There were also a bed of Sitka spruce, one of Douglas fir and one of Scotch pine. But there is another nursery in this revier, under the same förstmeister, in which the plants are nearly all Rottanne.

The cost of the plants, when placed in their final position in the forest, is from 2 to 4 pfennig (one half to one cent) per plant, a laborer being able to set out from 1,000 to 1,200 in a day. In setting out these plants in the field he uses a kind of mattock for making the holes, the same as is used in our plantations in New York. The daily wage of a laborer in this range is 1 mark 80 pfennigs, and hence the cost of annual planting in the forest, at the rate of 1,100 plants per day, is 1.6 pfennigs per plant, which leaves the apparent cost of the nursery work from .4 to 2.4 pfennig per plant, not including certain incidental expenses, which increase it somewhat.*

There are six nurseries in the Baden Revier, each about the size of the one at Geroldsau; but they vary greatly in the species propagated, some of them having ninety to ninety-five per cent of their area devoted to Norway spruce. The broad-leaved species are cultivated only to a small extent in this part of the Schwarzwald.

The nursery in the Wendlingen Revier, near Freiburg, is also devoted largely to the propagation of the silver fir. It is a permanent one, so denoted to distinguish it from the temporary ones often made to supply a local need. The natural soil is from gneiss, and is a limy sand. Manure is used as a fertilizer, that from cows being preferred. This is spread over the ground and spaded under before the seed is sown. Thomasmehl and kainit also are used.

The seeds in the seed beds are sown in rows, the rows being three inches apart, and are dropped so thickly in the row that they nearly touch each other. The beds are then covered with branches of fir or beech, which are allowed to remain all summer, at first close to the ground, after which they are raised gradually until they are about twenty inches high. These shades are also left on through the winter to keep the ground from freezing and heaving with the frost. Moss, or fine brush, laid between the rows might serve this purpose as well.

*These figures seem somewhat questionable, but they were noted down carefully from the forester's personal statement.

The seedlings are transplanted, when two years old, in rows six inches apart and at spaces in the row of about three and one half inches. They are held in the transplant beds until they are five years old before removing them to the plantations.

Although the purchase of seeds for nursery purposes is a common practice in some localities, the forester in charge of this revier gathers his own supply. As to the silver fir, a full mast occurs about every five years, although this species yields a small amount of seed each year. The cones are gathered about the middle of October. A man climbs up among the branches and breaks off the cones, which are carried immediately to the storehouse and spread out so that the air can circulate through them freely. They are stirred every day and kept in the drying-room until the scales have fully opened or fallen apart. They are then put into baskets and shaken vigorously until the seeds have fallen to the bottom, after which they are easily separated from the refuse material.

The seed beds are sown in autumn, sometimes in November or December, if snow does not fall too early. If the weather is very moist the cones may not open in time for fall planting. In that case the seed is, of course, sown the next spring.

The absence of nurseries in some parts of the Black Forest, or elsewhere, does not necessarily imply that young plants are not used there in reforesting operations. In the Sulzburg reviers, for instance, the oberförster, as explained by him, is doing very little in the way of seed plots, because he can buy seedlings from the commercial nurseries as cheaply as, if not cheaper than, he can raise them himself. This is not remarkable, as it is evident that in a nursery of one hundred acres or more, devoted solely to commercial purposes, the plants can be raised more cheaply, and with a profit, than in one of two acres, especially as in the latter case the forester has other and more important duties that engross his attention. Furthermore, under the excellent and intensive management of the Sulzburg reviers a satisfactory reproduction is obtained through natural dissemination.

Switzerland.

As most of the forests in this country occupy slopes, more or less steep, they exercise protective functions which necessitate the selection system in their exploitation, and hence there is not the same need for nurseries as in countries where clean cutting is practiced. Reproduction by natural dissemination is largely the rule, noticeably so in the forest of the Sihlwald, famous for its intensive management and the highly profitable returns per acre which have been main-



A. KNECHTEL, PHOTO.

FOREST TREE NURSERY, NEAR LUZERNE, SWITZERLAND.

ENCLOSED WITH A HEDGE INSTEAD OF A FENCE.



A. KNECHTEL, PHOTO.

TEMPORARY NURSERY.

PATHS PLANTED PERMANENTLY WITH NORWAY SPRUCE, WHICH WILL BE LEFT IN PLACE WHEN THE STOCK IN THE BEDS IS FINALLY REMOVED. A PLANTATION THUS TAKES THE PLACE OF THE NURSERY.

tained annually for a long term of years. Still there are several nurseries connected with the management of the various cantonal forests, but the technique as observed does not vary materially from that already described.

Although nurseries are not as essential to the management of high forests in Switzerland as elsewhere, a large number are used in the work of forest extension and the formation of new forests on wild or cultivated land that had hitherto not been used for the production of timber. From 1878 to 1885 the annual output of the nurseries devoted to this purpose amounted, on an average, to 5,263,474 conifers and 351,430 broad-leaved plants.*

In the Winterthur range temporary nurseries are used to a considerable extent. In some of these, when the stock is removed, a sufficient number of transplants are left standing at proper intervals in the beds to form an artificial forest in time on the site of the abandoned nursery plot. The permanent nurseries wherever seen are in admirable condition and have an attractive appearance. One of them, near Luzerne, is enclosed by a well-kept hedge instead of a fence, as customary everywhere else, and is equipped with water pipes and several hydrants for sprinkling the beds.

In the canton of Zurich there is a nursery connected with the Forest Research Station, in which experiments are carried on with different species of forest-tree seedlings and plants. It is situated at Adlisberg, four miles from the city of Zurich, at an elevation of two thousand three hundred feet above the sea.

To determine the species suitable for planting in various parts of Switzerland, soils from these places are brought to the nursery, seeds are planted, and the little trees as they grow are studied and their development carefully recorded.

An important experiment is being carried on with the seed of Norway spruce. Good seed collected in the mountains, some from trees growing at an altitude of one thousand five hundred feet above sea level, and some from similar trees at an altitude of six thousand feet, were planted in a bed in the nursery, half of the bed being given to each kind of seed. The seedlings, now six years old, show a remarkable difference in height, those from the seed taken at the lower altitude being twenty-four inches tall, while those from the higher altitude have a height of only twelve inches.

The natural laws under which the roots of trees are developed are being studied as follows: Boxes thirty inches high, eighteen inches wide and six inches through, with the sides made of glass, are filled with earth and sunk into the ground their full length, the glass sides standing vertically in close contact with the earth outside the box. In each box is planted a tree, which, as it grows, sends some of

* U. S. Consular Reports. 1887.

its roots against the glass sides. From time to time the boxes are pulled out of the ground and the root growths observed and recorded.

Observations upon white pine, Scotch pine, silver fir, beech, oak, birch and maple have been carried on for three years on plants aged from one to six years. During the winter, from November till March or April, the roots of the needle trees, as observed in the boxes, make no growth. Those of deciduous trees, on the contrary, do not go through this period with complete rest, but grow wherever the temperature becomes mild, even in midwinter. In February and the beginning of March, however, the roots show very little growth.

It is noticed that in the spring the roots begin to develop before the buds, in some cases several weeks. The larch and alder are an exception to this rule. The buds of these species have been observed to unfold even a month before the roots started.

Since the soil has a temperature below that of the lower air it follows that the roots begin their growth at temperatures lower than that necessary for the development of the aerial parts. The minimum temperature necessary for the growth of needle trees, as recorded by a thermometer placed in the boxes, is from five to six degrees Centigrade; for the maple and beech, from two to three degrees.

The roots have also a summer rest, in August and September, a time when the water content of the soil in the nursery is at its minimum. This interruption may last from three to eight weeks, according as the summer is wet or dry. Then follows in October a period of more active growth and of longer duration in the deciduous trees than in the conifers.

The most rapid development takes place at the beginning of summer. The oak has its maximum at the end of June or the beginning of July. The root growth is then about 3.54 inches a day, that of the fir and Scotch pine about 2.36 inches. From these observations a judgment is formed as to the most favorable time to plant trees in the forest. For the success of a plantation it is essential that, as soon as the trees are placed, the roots should enter upon a period of active growth to replace the water taken from the tree by evaporation. On the other hand, the plantation should be made when transpiration is at its minimum. These conditions are usually best secured in the spring. In a country, however, where the spring is usually dry and the fall mild and moist, the plantation should be made in the autumn.

For deciduous trees to grow well when planted in autumn they must form root hairs before the arrival of the great cold, and must lose very little water by evaporation during the winter. Hence, in countries where the winter is very cold and dry these, as well as the conifers, should be planted in the spring.

Alsace.

The Oberförsterei Münster, in the German Vosges, has an area of 21,325 acres, of which one half, or thereabouts, is occupied by silver fir;* the remainder by Norway spruce, Scotch pine (1,500 acres), beech (mixed with maple), elm and carpinus (5,000 acres), oak (1,150 acres), chestnut (180 acres) and locust.

The total nursery area for the tract is four acres, which furnish an average annual output of 160,000 coniferous plants. This nursery area is in several small plots distributed conveniently throughout the tract. One of these, located about five miles from Metzeral, has an area of five acres (5,380 square feet). It is in the forest and is closely surrounded by trees. A wire fence of four strands, with a round top-rail of poles, protects it from deer. The exposure is towards the west. It has a slope of one foot in eight, terraced with retaining walls of stone three feet high.

The soil is from gneiss, with some lime in its composition. Thomasmehl and kainit are used as fertilizers;† but as kainit is strong and liable to injure the plants

* The silver fir (*Abies pectinata*) of Southern Europe resembles the American balsam closely in its foliage and in many other respects; but it is much larger and taller and has a better fiber.

† *Thomasmehl*, or *Thomaschlacke* (Thomas slag), is a slag or scoria produced in the "Thomas-Gilchrist" process for manufacturing steel, and is obtained as a by-product from certain rich phosphatic iron ore. In this process the phosphorus of the crude iron is converted into phosphoric acid, which passes into the slag in combination with lime and iron. This slag is ground finely and sold as fertilizer. It contains from thirty to forty per cent phosphate of lime, the greatest part of which appears to be in an available condition, so that the slag, when ground or pulverized, may be used on the soil as a source of phosphoric acid without further treatment.

It is a new form of phosphate to which attention has already been attracted throughout Europe, and which has been tried experimentally to some extent in this country. From extensive trials of it at experiment stations it seems that all such slags have not an equal value, some being much more available to the plants than others. The better classes of slag have, however, given better results than bone meal, and have been sold at so low a rate the foresters can use it profitably. This slag meal is now manufactured at Pottstown, Pa., and is put on the market under the name of "odorless phosphate."

Kainit, or *Kalidungung*, is a product of some salt mines, notably the mines at Stassfurt, Germany. It is a mixture of compounds containing about twenty-five per cent sulphate of potash, equivalent to twelve per cent of actual potash, together with about thirty-five per cent of common salt, some sulphate and chloride of magnesia, and a small amount of gypsum. Large amounts are annually exported to America, one year as high as 87,635 tons.

Kainit, sprinkled on manure, tends to the checking of fermentation; also, to attract and hold moisture. One precaution should be observed in the use of this fertilizer; animals should be kept away from it, as their feet may be injured by treading in it. It is better, therefore, to apply it mixed with fresh manure, and to cover the ground afterwards with some kind of litter. [See bulletins on "Commercial Fertilizers," issued by the Departments of Agriculture in various States. For further definitions of Thomasmehl and Kainit, see *Illustriertes Forst und Jagd Lexikon*, by Dr. Hermann von Fürst. Berlin: Paul Parey. 1904.]

if applied when fresh, kali salts are used at times. This is a product of the German mines, containing about fifty per cent sulphate of potash and thirty-five per cent sulphate of magnesia.

Silver fir and Norway spruce are the species cultivated for the most part. These are transplanted when two years old, and allowed to remain until they are four or five years old before they are taken to a plantation.

In winter, to prevent the plants from heaving out by frost, they are covered with leaves from deciduous trees. Twigs of fir are stuck into the beds at close intervals, so that the wind will not disturb the leaf covering.

Saxony.

In no European country have improved forestry methods attained a higher development and degree of efficiency than in Saxony. In the United States consular reports it is stated that there is probably no country in the world where higher revenues from the forests are obtained, nor where greater or more intelligent care is bestowed upon them, and the forestry publications, official or otherwise, issued in that country indicate that this statement is well founded. Forests of wide extent exist everywhere, not only on the Erzgebirge and on the mountains of the Saxon Switzerland, but also in the vicinity of the principal cities.

The area devoted to the formation of coniferous forests is six times that given to the growth of deciduous species. Gen. C. C. Andrews,* in his "Notes on European Forestry," says of the Saxon forests: "The entire area planted annually varies according to circumstances. On the average it will reach 6,900 acres. Of this area 800 acres are planted up with seeds, and 6,100 acres are planted up with plants." This statement will give some idea of the large number of nurseries in Saxony which are necessary in making such extensive plantations.

On the Olbernhau Revier, in the Erzgebirge, there are several nurseries. This revier contains 4,694 acres, of which four fifths is covered with Norway spruce. The nurseries are temporary ones (*saatschule unständige*), small plots situated convenient to the areas in which the plants are to be set out.

The soil is good, consisting of disintegrated gneiss with considerable lime. For the temporary nurseries, small areas only are used. When a new place is selected for a "saatkamp," as the plot is called, the ground is not fertilized at first; but if it is used for a second crop the ground receives an addition of Thomas slag or kainit. Potash (kali) is sometimes applied instead of kainit, as the latter is too strong, and if used when fresh it injures the plants at times.

*Ninth Annual Report, Minnesota Forest Commission. St. Paul. 1904.



A. KNECHTEL, PHOTO.

NURSERY WITH SEED BEDS PROTECTED FROM BIRDS AND MICE BY WIRE SCREENS
AND STONE BORDERS.

AT OLBERNHAU, IN THE ERZGEBIRGE, SAXONY.



A. KNECHTEL, PHOTO.

YOUNG PLANTATION OF NORWAY SPRUCE MADE BY THE SEED-SPOT METHOD.

THARANDT, SAXONY.

These fertilizers are applied immediately after the plants are removed from the nursery, which is generally done in April. They are mixed with the soil, after which the ground is left undisturbed for two weeks. The beds are then made and the seed is sown in them. Where the nitrogen in the soil has been lost through washing and leaching, lupine is sown in the spring and left to grow until September, when it is spaded under.

The seeds in each row are placed thickly, nearly touching each other, in a depression made by a square-edged slat two and one quarter inches wide. The depression thus made is about three quarters of an inch in depth. The rows are about four inches apart. The beds are forty inches (one meter) wide, with intervening paths of one foot in width. For sowing an area of one are (1,076 square feet) about seventeen and one half pounds of spruce seed is used. The seeds are not soaked, but are coated with red lead to prevent the birds from eating them. After sowing, the seeds are covered lightly with sand which has been mixed with a compost made from leaves and grass.

The beds are covered with low screens of brush, preferably pine, which are left on the frame until the latter part of July. Water is not used for sprinkling unless there is a supply conveniently at hand.

Seedlings are left in the seed beds until they are two years old, when, as a general rule, they are transplanted into other beds; but sometimes they are left in the germinating beds until they are four years old, in which case they are sent direct to the field plantation. The climate in the Erzgebirge, however, is so unfavorable that the foresters deem it advisable, in general practice, to use transplants.

The expense of raising two-year-old seedlings in the Olbernhau Revier is from one to two marks per thousand plants; to prepare the soil and transplant them costs one and one half marks more per thousand; and to set them out in a plantation, from ten to fifteen marks per thousand.

Field planting by the seed-spot method, a modified form of nursery work, is extensively practiced in Saxony, and plantations of this kind are made at Tharandt, the seat of the Royal Forest Academy. The Saxon foresters generally sow the seeds along the edge of the strip or patch, where they are not so liable to be heaved or thrown out by frost. In the Erzgebirge, wherever this method is used, spruce is not mixed with pine or larch as at Tharandt. At the latter place a mixture is used to protect the spruce from the deer. A few seeds of pine and larch are mixed with the spruce seed, and as the former have a more rapid growth, and are preferred by the deer, the spruce remains uninjured.

At the Oberwiesenthal Revier, in the Erzgebirge, along the Austrian border, the technical work in the nurseries is about the same as that just described.

The nurseries are devoted almost exclusively to the propagation of Norway spruce. The soil for the most part is of a kind known there as fillet, which is composed largely of fine particles of gneiss.

For fertilizing bone meal (*aufgeschlossenes*) is used exclusively, sixteen pounds per are. In making a plot ready the trees are cut, the stumps taken out, the ground dug up and thrown into heaps in autumn, after which the bone meal is mixed with the heaps. In the following spring these heaps are spread over the ground, beds are made and sown, the seed having been mixed with lead-oxide, two pounds of the latter to sixteen pounds of seed. The depression in the bed having been made, the seed is sown thickly in them and then covered with a thin layer of fine earth that has been put through a sieve, after which the surface is pressed down gently.

Dry branches of spruce, bare of foliage, are laid on the beds for shade, and are held in place by poles laid on them. This brush is left on the beds until the plants come up through the ground, when it is removed and is not used again. Dead branches are used, because the spruce needles, which otherwise would fall on the beds, are heating in their effect and would injure the plants.

In July or August fresh humus is strewn between the rows, two cubic meters per are. This keeps the ground moist, hinders the growth of weeds and prevents heaving out by frost. This humus, composed of decayed needles, is found in the forest underneath the layers of freshly fallen leaves.

The plants are not watered. The foresters in these reviers claim that if water is once used during a drought the sprinkling must be continued until rain comes, or the plants will deteriorate in a noticeable degree.

The seed beds are made one and two tenths meters wide and of any convenient length. On a slope they are laid out lengthwise across the slope so that the flow of water from a heavy rainfall is checked or hindered. Side paths are twenty-five centimeters wide, and are made shallow, so that the beds will not dry out too much along their sides. The end paths are fifty centimeters broad, and are a little deeper. If the slope is such that there is danger of flooding and washing, a ditch is dug near the upper side of the inclosure, which is fenced for protection from deer.

As usual, the plants are left in the seed beds until two years old, when they are transplanted into other beds in the same nursery and treated with a fertilizer the same as the seed beds. At Oberwiesenthal the transplant beds are nearly square, three and five tenths centimeters on a side, with paths fifty centimeters wide.



A. KNECHTEL, PHOTO.

TEMPORARY NURSERY, NORTHERN AUSTRIA.

THE GROUND OUTSIDE THE FENCE IS PLANTED WITH FOUR-YEAR-OLD TRANSPLANTS.



A. KNECHTEL, PHOTO.

PART OF FOREST TREE NURSERY, THURINGIA, GERMANY.

THE BEDS IN THE BACKGROUND, WITH ROWS SHOWING DISTINCTLY, ARE WHITE PINE.

Square beds are very unusual in European nurseries, although in some of the commercial nurseries in Germany large areas filled with transplants may be seen in which there are no paths.

A spade is used to take up the seedlings for transplanting. It is shoved down between the rows, then pressed upwards, after which the plants are gently and carefully removed by the workman with his fingers and placed in a box-like frame made of slats. The seedlings are carried to the new bed, where they are set out in drills four inches apart and the earth pressed firmly by hand around the roots. The rows or drills in the transplant beds are made at intervals of five inches. The infant trees are transplanted only once in the nursery and are left there until they are five years old, as the climate is somewhat severe. Weeding is necessary only twice a year, in the spring and fall.

In the Erzgebirge a plot is generally used for a nursery only once or twice, after which it is abandoned. If used a second time, bone meal and humus are applied in the same quantities as at first. The humus is not only a fertilizer, but it acts mechanically, making the soil looser where it is too firm and firmer where it is too loose.

Field plantations are made from the middle of May until the middle of June, the spring being late in these regions, as they are situated 2,800 feet or more above sea level. The stumps are not removed from the ground which is to be planted, but good earth is hauled there and distributed in small heaps, and in quantities of about ten cubic meters per hectare (two and one half acres).

Transplants are taken out of the nursery bed and heeled in. At the proper time they are hauled in a wagon to the planting ground, and heeled in again as deep as they stood in the nursery. They are taken up again as fast as needed, placed in pails or baskets and carried to the men who do the planting. They are planted 1.4 meters apart, and are set in the earth that is thrown up at the side of the hole (*lochhügelpflanzung*), two or three handfuls of the good earth being packed around the roots of each. By this method the plants receive nourishment from the grass and sod beneath the hillock.

The preparation of the ground for a seed plot costs about 22 marks per are, the expense being made up as follows: Clearing and digging the ground, 10 marks; bone meal, 1.20 marks; seed, 1.20 marks; making the beds and sowing the seed, 5 marks; covering with brush, 2 marks; lead oxide, 0.10 marks; spreading humus, 3.2 marks—or about \$5.50 for a plot 33 feet square. These figures may seem rather high, but they were furnished by the oberförster from his account book.

Transplanting costs: Digging over the ground in autumn, 10 marks; bone meal, 1.2 marks; making beds, 3 marks; transplanting, 10 marks, and humus,

3.2 marks; total, 27.4 marks per are, or about \$6.75 per area of 33 feet square. Removing the plants from the nursery and setting them out in a plantation costs about \$4.25 per 1,000 plants, and to grow the trees in the nursery, ready for planting, about \$1.75 per 1,000.

Thuringia.

At Eisenach, in the Thuringian Forest, there is a revier of about 11,000 acres in which there are six permanent nurseries, each in the vicinity of the planting grounds where the young stock will be needed.

The soil is fertile, being composed largely of disintegrated gneiss and feldspar. The nurseries are located on gentle slopes, where the plots can have a northern or eastern exposure in order to avoid so far as possible any injury from frost, and preferably on land from which a growth of beech has been removed. In many of them sufficient space is maintained between the sides of the enclosure and the forest so that the ground will not be shaded by tall trees. Protection from wind is deemed unnecessary.

In preparing the plot the trees are cut and the stumps taken out. The ground is spaded to the depth of one foot, so that it may freeze and pulverize in the winter. In the spring it is again dug over and beds are made, thirty-nine inches wide, with narrow sidepaths one foot in width.

Fertilizers are not applied for two or three years. Then humus and rich earth are mixed with the soil immediately after the plants are removed. Seed is sown as soon as the danger from frost is passed, about the last of April. The coating of the seeds with red lead is deemed unnecessary here. The rows in the seed beds are four and one half inches apart. A narrow slat of wood, pressed into the earth with the foot, is used to mark the rows and make the depression in which the seeds are placed.

Spruce is sown twice as thickly as pine and about one fifth of an inch apart. Larch is sown as thickly as spruce, because fifty per cent of the seeds do not germinate. Spruce and larch seed is covered to a depth of a quarter of an inch with humus or sand, or with a mixture of both, while pine is sprinkled with it so lightly as to barely hide the grains from sight.

Branches of pine are then laid on the beds; but spruce brush is not used, as the dead needles, falling on the ground, are liable to become heated and thus injure the seedlings. When the plants appear and are a month or so old, the branches are placed upright for shade. These are taken off in a dry time to allow the night dew to refresh the plants, and are removed entirely when the seedlings are strong enough to do without shade.



A. KNECHTEL, PHOTO.

FOREST TREE NURSERY IN THE THÜRINGER WALD, SAXE-GOTHA.



A. KNECHTEL, PHOTO.

NURSERY PLANTED EXCLUSIVELY WITH NORWAY SPRUCE.

AT RUHLA, SAXE-GOTHA.

Ammoniated superphosphate is scattered broadcast over the beds in June, twenty grammes per square meter, preferably just before a rainfall. It may be added a second time a month later, but usually this is not necessary. In autumn moss is laid between the rows to keep the seedlings from heaving; if a supply of moss cannot be obtained conveniently, dead leaves are used for the same purpose. This covering is removed the next spring, as soon as the danger from frost is over.

Seedlings are transplanted when one year old, as they grow better than when left in the seed bed until they are two years old, and the transplanting is less expensive. The seedlings are put into water when lifted from the seed bed to prevent them from drying out in any degree whatever during the transfer. They are set out in the transplant beds two and one half inches apart and in rows five inches apart, just wide enough to permit the use of a hoe in weeding. They are left in the transplant bed two years; but if they are to be used in a plantation on grassy land they are held there one year more, or until they are four years old.

The nursery near Annathal has a rectangular area of 100 by 138 feet, sloping slightly to the southeast. The natural soil is a fertile loam, enriched by a liberal admixture with forest humus and supplemented annually with mineral fertilizers.

In the ground plan the beds are laid out sixty-five feet long and three and one quarter feet wide. A walk, three feet in width, runs across the middle of the plot and around its sides at the fence. Long paths, twenty-two in number and a foot wide each, separate the beds, with one wide path down the middle.

The seedlings in the germination beds, one and two years old,* are in rows running across the beds, the seed having been sown in furrows or depressed lines, not broadcast over the entire surface as practiced in many European nurseries. But the transplants are set out in rows running lengthwise of the beds, six rows in a bed. The coniferous species propagated in this nursery consist entirely of Norway spruce and Scotch pine. In a small portion of the enclosure there are some thrifty broad-leaved plants—horse chestnut, European alder and speckled alder.

Another nursery, in an adjoining range on the road to Liebenstein, has an area of 120 by 150 feet, and is situated on ground sloping to the south, where it is bordered on that side by a clearing of ten acres or more. The other three sides are closely hemmed in by a dense forest. The beds are three and one quarter by fifty feet, containing five rows of plants, lengthwise, mostly Norway spruce. Quite a large area, comparatively, is occupied by sycamore maples, three years old.

In making a forest plantation in Thuringia the transplants are set out by women mostly, who work for one and one half marks per day of ten hours. The

* Seed beds are made each year.

plants are placed in the field at a cost of one pfennig each, including all incidental expenses. They are planted at intervals of one meter, or 10,000 plants per hectare —about 4,000 per acre.

Most of the nurseries in the Thüringer Wald are small, each with an area of less than one acre. But at Ruhla there is a permanent one of two and one half hectares (six and one quarter acres) planted entirely with Norway spruce. In fertilizing, four centners (four hundred and forty pounds) of Thomasmehl and two centners of kainit are used for one morgen or quarter hectare. After the seeds have germinated in the seed beds ammoniated superphosphate is strewn between the rows.

The seed is sown by hand, about the end of May, in drills along the beds so that the plants can be protected with moss in the late autumn. The seed is sown thickly. No screens are used. The seedlings stand in the seed beds until two years old, when they are removed to other beds, where they remain two years more. As a general rule, four-year-old transplants are used in making a plantation.

Prussia.

The forest at Friedrichsruh, near Hamburg, covers 18,750 acres, divided into eight reviers. The eight nurseries necessary for the annual planting occupy, in all, four hectares, or about ten acres of ground. One of the best of these is situated about two miles from the railroad station at Friedrichsruh, in the Bismarck Forest, a large tract of woodland presented to the German Chancellor by the government in recognition of his services in the Franco-Prussian war.

This nursery has an enclosure of 200 by 150 feet, is on level ground and is surrounded on all sides by an old forest, mostly beech, which comes close to the fence.

The coniferous plants raised here are mostly rottanne, with a few beds of Douglas spruce. About one fourth of the area is devoted to broad-leaf plants, the greater part of which are pedunculate oak. There is no arrangement for screening the seed beds to protect them from birds; but a stuffed hawk, perched on a stake close by, seems to answer the same purpose to a satisfactory extent.

At the Revier Hohne, in the Hartz, temporary nurseries located in the center of the planting ground are the rule. The soil, derived from granitic formations, has a natural fertility that is sufficient for the propagation of plants; but if a plot is used a second time, mineral fertilizers, of the kinds already described, are applied, with some lime (*kalk*) also in a few instances. Its elevation is only forty-five feet above the sea. In both seed beds and transplant beds the rows run lengthwise.



H. G. STEVENS, PHOTO.

FOREST TREE NURSERY, NEAR FRIEDRICHSRUH, NORTH PRUSSIA.



H. G. STEVENS, PHOTO.

NURSERY FOR DECIDUOUS TREES, BISMARCK FOREST.

GERMAN FORESTERS IN UNIFORM.



As usual, in Northern Germany, spruce is cultivated almost exclusively, or to a large extent. Seed, coated with lead-oxide, is thickly sown in the germinating beds about the middle of May, in rows four and one half inches apart. Brush is not laid on the beds, as this is considered unnecessary except as a protection from birds; but moss is used to protect the seedlings during the winter. The latter is placed on the beds in October and is not removed in the spring until the snow has melted.

Seedlings are usually left in the beds two years—or one year if very strong and thrifty—and are then transplanted in rows six inches apart, where they remain two years; but if the field where they are to be set out finally is covered with grass the plants are given one year more in the nursery beds.

The Forest of Grabow, in Mecklenburg, belongs to the city. It has an area of 6,470 acres. A forester (*stadtförster*) manages it; a hunter (*stadtyäger*) protects the game, and an overseer (*forstaufseher*) guards it against fire and trespass. The overseers are not technically educated men, but are chosen from the ranks of the workmen. The revenues are paid into the city treasury, after which the net income is applied to the reduction of taxes. This custom is common in most of the city and communal forests in Germany.

As the soil in the vicinity of Grabow is sandy, its forests consist almost entirely of Scotch pine (*Pinus sylvestris*), a small area only being planted with spruce (*Picea excelsa*) and silver fir (*Abies pectinata*). The broad-leaved trees also occupy a small area, where the fertility of the soil may indicate their use. But the soil is very poor, to a great extent consisting of a light colored sand which, even when damp, will not cohere if squeezed in the hand.

The nursery is located at an altitude of 335 feet. In summer the temperature rises as high as thirty-two degrees (Reaumur) in the sun, and twenty-four degrees in the shade; in winter it falls as low as twenty degrees below zero, same standard. The winters, however, are mild. The first frost occurs about the middle of November, and freezing weather is liable to last until the middle of April, with an occasional frost in May.

The seed for the nursery is generally purchased from commercial dealers, mostly from a seed house in Darmstadt. The seed beds require a large amount of mineral fertilizers, owing to the barrenness of the natural soil. For this purpose the forester uses Thomas meal, sixteen per cent citrates, in quantities of 880 pounds per hectare ($2\frac{1}{2}$ acres); carnallite, about 2,200 pounds per hectare, and slaked lime, 6,600 pounds per hectare. These compounds are mixed with fine turf, scattered thickly over the ground in winter and in the following spring are worked thoroughly into the soil. The turf is also strewn between the seedlings in the second summer of their growth.

The Grabow nursery has an area of about half a hectare. The beds are laid out forty inches wide, and of any convenient length. The sidepaths are one foot, end paths thirty-two inches, and wagon roads ten feet in width.

The seed is sown from the fifth to the fifteenth of April, in rows about four inches apart and so thickly that the grains touch one another in many places. Sowing in rows instead of broadcast is done to facilitate weeding. The seeds are covered, about half a centimeter deep, with natural soil, unfertilized, which is not pressed down as done elsewhere in many instances. Scotch pine is usually sown first. No screens are used; but the beds are sprinkled daily in time of drought, enough water being used to moisten the ground thoroughly.

Scotch pine is left in the seed beds for one year only, after which the seedlings of this species are sent to the plantations. If left in the seed beds after they are one year old the crowded condition of the plants induces the fungal growth known as "*schütte*." If, however, the plants are needed for a plantation on grassy land, the seedlings are transplanted into the nursery beds, set out there eight inches apart each way, and allowed to remain another year before their removal to the field.

Bavaria.

The forests in the Spessart are composed so largely of oak and beech that in this region the proportion of nurseries is not so large as elsewhere.

In the Forstamt Hain the plots are about one eighth of an acre each in size. In one of these, near the village of Hain, various coniferous species are grown—white pine, Norway spruce and larch predominating.

The method by which the beds are covered for winter is somewhat peculiar. Green branches of silver fir are used for this purpose. The beds containing white pine yearlings have each a pole fixed along the center at a height of one foot above the ground. Long branches are laid against this, with their lower ends resting on the paths between the beds. The white pine and Norway spruce, two years old, have twigs laid between the rows. The Norway spruce, one year old, is covered with the branches laid flat upon the bed, entirely covering it. The larch is left uncovered through the winter.

The nursery lies almost level. It is protected from deer by a fence of woven wire with a round top-rail, above which are two strands of barbed wire. In its minor details the management is the same as that at most other nurseries in Germany.

The methods prevailing in the various nurseries as described here will give a fair idea of the technique employed. Further examples might be given, but they would offer no additional information and would involve unnecessary repetition.



A. KNECHTEL, PHOTO.

WEEDING TRANSPLANT BEDS OF SCOTCH PINE.
THIS NURSERY BELONGS TO THE CITY OF GRABOW, MECKLENBURG.



A. KNECHTEL, PHOTO.

FOREST TREE NURSERY, GERMANY.
IN THE FOREGROUND ARE BEDS OF RED OAK SEEDLINGS, TWO YEARS OLD. IN THE BACKGROUND, SAME SPECIES,
FOUR YEARS OLD.



In General.

By way of summary it may be said that, in general, the following methods are observed:

In locating a nursery no great importance is attached to the question of exposure or slope, the site being selected with reference to reasons that are more essential in connection with the management of the revier. Neither is the altitude taken into consideration, as nurseries may be found everywhere, from the low countries at sea level up to the mountain forests of the Apennines or Vosges 3,000 feet above tide. The location may be determined by the nearness of water, which may be needed for sprinkling the beds in time of drought, or for irrigation. But the use of water is avoided as far as possible on account of the extra expense, and because, as claimed by some, that when once resorted to it must be continued.

Square or rectangular enclosures are generally made in order to secure a better ground plan, regularity in the form of the beds, and to economize in fencing.

In nearly every instance the enclosure is closely surrounded by a high forest that furnishes climatic protection to a great extent, although in a few localities the foresters deem the shade from the trees as somewhat of a detriment. All use carefully prepared or screened earth, free from gravel, stones and roots, to which a liberal addition of compost or mineral fertilizers is made each year.

In making the ground plan long beds are preferred, with the rows of transplants running lengthwise. But in many nurseries the seed beds are planted with cross-rows to facilitate weeding. The broadcast method for sowing seed beds, however, seems to be a favorite one. Where this is practiced the seeds are distributed thickly and as evenly as possible over the surface of the bed, after which the top earth is raked over carefully and smoothly to cover the seeds. Another method consists in spreading a very thin layer of rich, fine earth over the seeds instead of raking them under; and it is claimed that a more even catch is thus secured.

In order that the ground may attain the highest degree of fertility the forester often suspends operations in his nursery at intervals of four or five years, and, after the plants have been taken up, allows the ground to lie fallow one season, as the exposure to rain, frost and snow has a recuperative effect on the soil. Good results are further obtained by using the ground one season for an agricultural crop, in the cultivation of which manure is used; and there is in addition a beneficial working or division of the soil.

The size and number of the nurseries under any one management is proportioned to the area of the plantations to be made. If two-year-old seedlings are

to be used in the fieldwork, set out at spaces of four feet each way, the nurseries for this purpose have, as a general rule, a combined area equal to one per cent, or less, of that of the planting grounds. Schlich says one half of one per cent.* But if four-year-old transplants are to be used the nurseries must necessarily have a larger area, one which in their aggregate will be equivalent to four per cent of that of the plantations. This percentage, however, applies to coniferous species only. Broad-leaf plants, which are usually set out at wider spaces, require a much larger percentage of area for their propagation. An enclosure of two acres, after setting apart enough ground for seed beds, will furnish each year about 138,000 four-year-old transplants of coniferous species, the number varying somewhat according to the space allotted to paths and roadways.

A nursery may be permanent or temporary as forest conditions may require. The latter is made in some instances merely to supply plants for some particular locality, after which, being no longer necessary, it is abandoned. If the plot will not be needed again for many years it is allowed to grow up to a young forest, some of the taller and more promising transplants being left in the beds at proper intervals for this purpose.

In most nurseries screens are used for protection against heat and frost and for protection against birds; and the beds are covered during the winter with moss or litter to prevent the seedlings from heaving. But the practice in these respects varies with the species and according to the climate or soil.

Protection from Deer.

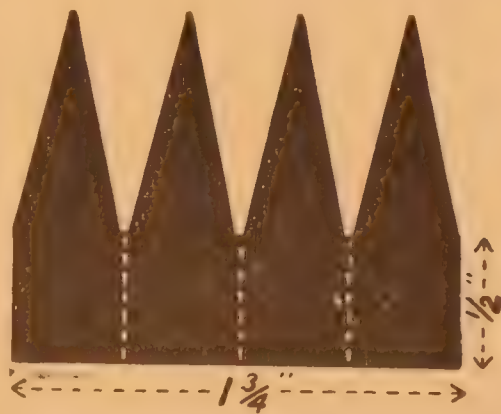
Although every nursery is surrounded by a fence or hedge to protect the stock from the deer, there are often large areas just outside the enclosure, freshly planted with four-year-olds, to which these animals have access. If the leaders on the plants are cropped by deer or cattle, the young tree is retarded in growth and is liable to become distorted in shape.

At a nursery in Thuringia a large area just outside the fence was recently filled with five-year-old transplants of Norway spruce. To prevent the deer from nipping the leaders, for which these animals have a decided partiality, each plant had a sharp tin guard bent around the tip. (See illustration.) These tins before using are flat, one and three quarter inches long, one half an inch wide, and notched into four points at the top edge. This strip of tin is bent into a square, each side having a point, and slipped on the leader so that the points project above the tip. They are bought by the thousand, and are placed on the

* Schlich's Manual of Forestry. Vol. II, p. 99.

plants at a merely nominal expense. As a deer nips at the leader first instead of the side shoots, its sensitive nose receives a pricking that induces the animal to desist immediately from further effort.

This device has proved very effective. But the tins fall off in time, become rusty, and when the barefooted women and children who work in the nurseries and plantations step on one of them lockjaw is liable to ensue. Deaths from this cause have occurred so frequently that some foresters will no longer permit their use. A *förstmeister* at Eisenach, who deprecated their use strongly, secures protection for his plants by painting the leader on each with a mixture in which beef's blood forms a large component, the putrid odor proving as efficacious and as repulsive to the nose of the deer as the sharp-pointed tin. Small wads of cotton or tow tied to the terminal buds are also used by some foresters to protect young plants, but this method requires so much time in affixing the material that it is regarded generally as expensive and impractical.



Shape of tin guard before using. It is bent squarely at the places indicated by dotted lines before placing it on the tip of the leader.

Commercial Nurseries.

The commercial nurseries in Germany are remarkable for their great areas, intelligent management and economical methods. Their annual output of plants and seedlings is figured in millions—many millions*—and their superior advantages enable them to supply, at a profit, the demand from forest reviers, and also from the smaller nurseries in Europe and America, the proprietors of which prefer to buy their seedlings instead of operating seed beds themselves. These commercial nurseries are well worth the careful attention and personal observation of any one who is interested in this branch of silvics.

The principal nurseries of this class are located at Halstenbek, in Holstein, and at Knittelsheim (railroad station at Bellheim), in the Rheinpfalz. The former is near the city of Hamburg, and the American forestry student who crosses the ocean on the Hamburg line will find Halstenbek a convenient place to visit in pursuing his studies. The latter is not far from the northern part of the Black Forest, and is easily reached from there.

* The advertising circular of one firm this year showing the number of plants of each species for sale indicates a stock on hand of 56,959,000 seedlings and transplants.

There are several firms at Halstenbek engaged in this business one of them having 200 acres or more laid out in beds, or large plots without paths, with an annual product of several million plants. They supply the managers of State, communal and private forests who have no nurseries of their own, or who find that they can purchase their plants cheaper than they can propagate them on their own reviers, or who may need an extra supply at times in addition to that raised on their own land. Shipments are also made to America, both to foresters and nurserymen. The latter import one and two year old seedlings, and set them out in their nurseries.

A visit to the commercial nurseries of Germany, and an observation of their immense annual output, will give some idea of the great extent which the planting of artificial forests has attained throughout Europe. It indicates clearly the practical value of the system and commands the attention of American foresters, who will find in it a good precedent for similar work at home.

A notable feature of the business at these places is their large sales of two-year-old seedlings and three-year-old transplants. The demand for four-year-old transplants is comparatively small, due largely to the extra price and greater expense of packing and freight.

The three-year-old plants may be seedlings, or yearlings that, having been transplanted, remained two years in the beds; or, two-year-old seedlings that were taken up and given one year in the transplant beds.

The prices of coniferous plants at the commercial nurseries, delivered free on board cars at the nearest railway station, are about as follows:

SPECIES.	Age, years.	Inches.	Per 1000.
White pine, once transplanted	4	8 to 15	\$2 75
White spruce, once transplanted	4	8 to 16	2 50
Norway spruce, once transplanted	4	10 to 18	2 50
White pine, once transplanted	3	4 to 6	1 75
Norway spruce, once transplanted	3	6 to 12	1 75
Douglas spruce, once transplanted	3	8 to 16	5 50
Larch, once transplanted	3	16 to 22	4 50
Scotch pine, once transplanted	2	4 to 6	1 25
White pine seedlings	2	3 to 4	1 50
Larch seedlings	2	6 to 15	2 00
Norway spruce seedlings	2	4 to 12	75
Douglas spruce seedlings	2	5 to 12	3 00
Scotch pine seedlings	1	2 to 3	50



A. KNECHTEL, PHOTO.

COMMERCIAL NURSERY, HALSTENBEK, HOLSTEIN.
NOTE THE HEDGES OF WHITE CEDAR, TO SCREEN THE BEDS FROM WIND.



A. KNECHTEL, PHOTO.

FIELD OF WHITE PINE, FOUR YEARS OLD, TRANSPLANTED.
COMMERCIAL NURSERY, GERMANY.



For large orders (50,000 to 100,000) a satisfactory discount is made from the above figures; but the price-lists of the nurserymen vary at times, influenced by a surplus stock or scarcity of the particular species quoted. The plants, wrapped in damp moss, are packed for shipment in large baskets, or in crates constructed of open willow-work, and an extra charge is made for packing and packages. On shipments to the United States there is a tariff of twenty-five per cent ad valorem, which, together with the freight and the risk in transportation—the long time in which the plants are packed—renders an importation a somewhat doubtful expedient.

The methods employed in the commercial nurseries are substantially the same as in the nurseries belonging to the forest reviers; but more attention is paid to minor details. The supply of seed, however, is purchased from salesmen instead of collecting it from the forest. The seeds of all needle-trees are kept during winter in sacks, stored in a cool place, but the seed is not mixed with sand as advised in some textbooks. The sowing is done in April and May.

The Halstenbek nurseries are on level ground, at an altitude of only thirty-two feet above tide. The seed beds are made of black soil—a good loam that will not fall apart if pressed in the hand. Manure from the streets of Hamburg is used largely as a fertilizer, and it is scattered over the ground in winter.

The seed beds are mostly four feet wide and about sixty-five feet long. Broadcast sowing is the rule, in order to obtain a fuller utilization of the soil. If the seeds when tested show a high percentage of germination, they are sown so that the grains lie about one quarter of an inch apart; if the seed is poor it is sown more thickly. The coniferous plants are not screened; but in time of drought the beds are sprinkled, some of the nurseries having installed an irrigation plant for this purpose.

White pine, Norway spruce, balsam (*Abies balsamea*) and silver fir are left in the seed beds until two years old; sometimes the firs are left still another year. Scotch pine can be left in the seed bed only one year with safety, as the plants are liable to suffer from “schütte,” a fungous disease that is developed in this species by the crowded condition of the seedlings in the second year.

White pine and Norway spruce, when transplanted, are set two inches apart in the row, if the plants are to remain there only one year; but they must be placed farther apart if they are to remain a longer time in order to permit of their increased growth. The rows are made with spaces of six inches between them, or wider if the plants are to stand there two years. These simple requirements must be observed in order to secure thrifty plants and to avoid crowding in the beds.

Scotch pine yearlings, when transplanted, are placed two and a half inches apart in the row, and the rows are laid out ten inches apart. This wide spacing of the rows is to prevent any loss from schütte. If this species is given another year in the nursery the plants must be transplanted again and given more space for growth.*

In Germany Scotch pine is generally taken directly to the forest plantations when the seedlings are one year old. If they are to be set out on grassy land, however, they are allowed the benefit of one year first in a transplant bed; and if the grass is thick or apt to overshadow them too much, they are transplanted twice.

From the Halstenbek nurseries white pine is often sent to the forest when two years old, untransplanted; or three years old, once transplanted, if they are to be used on grass land. It is claimed by the commercial nurserymen that this species grows too slim and that the root system is poorly developed if left in the seed bed more than two years.

Douglas spruce, balsam fir (*Abies concolor*) and silver fir are protected from frost for the first two years by mats made of coarse reeds supported by long poles laid along the beds on stakes one foot in height. The Douglas spruce is protected from the wind by hedges, for which purpose white cedar is planted at one side of the beds. These hedges are used to considerable extent at Halstenbek, although they are not essential to the growth of other species. They also serve to shelter the workmen from the cold winds prevalent there in spring and fall.

The seeds of most of the broad-leaved trees are sown in March and April; but the seeds of basswood, ash and thorn are kept in "seed-chests" eighteen months before planting. These seed-chests are compartments made of brick, with an inside measurement of thirty-nine inches in length, twenty inches in width, and twenty inches high. They are placed out doors, partly below the surface of the ground, in rows of ten, each row surrounded by a thick hedge of white cedar. The seeds stored in them are usually mixed with sand, although this is not deemed essential, and a mat made of straw is laid over them. With this treatment the seeds when planted germinate and come up quickly, usually in two weeks.

In the propagation of deciduous species, beds are made about the same as for the needle-trees, and the seeds are sown in rows lengthwise with the bed, seven rows in each. The drills or depressed grooves are made with a machine; but

* While this treatment of Scotch pine may be necessary at Halstenbek to prevent disease, in American nurseries this species is left in the seed beds two years, and in the transplant beds two or three years with perfect safety, no matter how closely the seeds may be sown or the transplants placed.



A. KNECHTEL, PHOTO.

WEEDING TRANSPLANT BEDS.

COMMERCIAL NURSERY, GERMANY.



A. KNECHTEL, PHOTO.

LARGE BEDS OF NORWAY SPRUCE, FOUR YEARS OLD, ONCE TRANSPLANTED.

COMMERCIAL NURSERY, GERMANY.



the seed is sown and covered by hand. The rows are seven inches apart, but after one year the alternate rows are taken out. The seeds are sown thickly, so that the plants will stand about four inches apart.

Needle-plants are shipped in large, cylindrical baskets—Scotch pine, one year old, 15,000 in a basket; white pine, one year old, 30,000; two years, 10,000; three years, 7,000; and Norway spruce, two years, 15,000; three years, 8,000. Paper is laid in the basket, on the bottom and around the sides, next to which is placed a layer of moss. A bunch of straw is then placed vertically in the center of the basket. The plants, which are tied into small bundles before taking them from the field, are placed in the basket with their tops towards the outside. From the center to the side of the basket three circular rows of bundles can be placed, which, however, overlap each other at one end like the shingles on a roof. Each layer of bundles is covered with loose turf before the next layer is put into the basket. The bunch of straw standing in the center permits the escape of heat, the paper prevents the escape of moisture, while the moss and turf hold the water that supplies the necessary moisture during transportation.

When a shipment is to be made the plants are lifted from the beds during the day, tied in small bundles and each bundle buried lightly in the earth, this work being done usually by women. Then in the evening the bundles are gathered and hauled to a cellar where they are packed in baskets the next day for shipment. Two men pack from 3,000,000 to 4,000,000 plants (one and two years old) in a day. The baskets are then weighed, loaded on wagons and hauled to the railroad station, which at Halstenbek is close by the nurseries. Broad-leaf trees are put up in large bundles and wrapped in straw for shipment, the roots covered with burlap. The proprietor of a large commercial nursery at Knittelsheim, in his instructions to purchasers, says:

“Plants should be taken from the railway station promptly after their arrival. If they cannot be planted immediately they should be heeled in, care being taken that the roots are properly covered with earth. During transportation, whether on the railroad or on the delivery wagons, the plants should be covered with straw or otherwise sheltered from the sun and winds. If, on account of frosty weather, they cannot be set out immediately, they should be put in a cellar in upright position close together. Plants which arrive in a heated condition, as sometimes happens with Scotch pine, should be treated the same way. Immediate watering while stored in damp cellars must be avoided, or the roots will become rotten; and in no case should frozen plants be put in a warm room. It is also dangerous to hold a Scotch pine yearling in the hand longer than necessary, as the warmth will affect it unfavorably. Shortening the roots will, in most cases,

promote a better development of the fibrous growth. A sharp knife should be used, and a downward cut made. In trimming transplants it is sufficient to shorten the root-hairs merely and to remove the dead ones. Transplants cost more than seedlings; but, in most cases, it is false economy to buy the latter, for transplants are stronger, have a better root system, and are more able to withstand all unfavorable influences."

Commercial Seedsmen.

In all nurseries, whether commercial or otherwise, a supply of good seed is an important matter. To a great extent the commercial nurseries, and many of the forest nurseries as well, obtain their seed from dealers who make a specialty of collecting, preparing and storing forest-tree seed in large quantities. Mercantile houses that deal in seeds only may be found in most any of the principal cities of Europe. Having superior facilities, through specialized work, for carrying on this business they are able to offer better seed and at lower prices than the nursery managers can collect it.

Seeds of the principal coniferous species can be bought from any of the large seed houses in Europe at the following rates, subject to variation at times caused by a scarcity or plenty of some particular kind:

	Per pound.
White pine	\$2 05
Scotch pine	57
Norway spruce	23
Silver fir	14
European larch	35

Seeds that show a very high percentage of germination may command a slightly higher price.

Their houses in which the cones of the needle-trees are dried and the seed extracted are each furnished with a specially devised apparatus. In some of them the heat is regulated by electricity in order to secure a more even temperature and thereby avoid any overheating of the cones, which would destroy the germinating quality of the seeds. They also have special facilities for cleaning, drying and storing seed; and in every detail the methods employed are based on long experience in this special work.

In any of these seed houses may be seen some kind of device or apparatus for testing the vitality of seeds and their percentage of germination, an important

item in the business. Still, in order to satisfy customers, official tests are also obtained by prominent dealers. A seed house in Knittelsheim advertises that its collections are tested for "purity and germination" by the "Swiss Control Office for the Examination of Seeds," at Zurich, Switzerland.

Foresters who gather seed for use in their own nurseries have various well-known tests of a simple character to determine its value. But there are several government stations to which samples of stock may be sent to be tested and to determine the percentage of germination. The principal ones are located at Eberswalde and Tharandt, in Germany; Zurich, in Switzerland, and Mariabrunn, in Austria.

These official tests enable the nursery manager to avoid any loss caused by sowing worthless grains, to protect himself against fraud on the part of unscrupulous dealers and to determine the quantity that should be sown.

If a report is needed immediately from the station, a number of seeds are cut open and examined for color, plumpness, taste, odor, etc. For example, the kernel of the beech and the chestnut, if all right, is white and very pleasant to the taste; that of the oak is reddish white; the maple, green; the ash, white and waxy; pine, white with a strong odor of turpentine. Coniferous seeds are crushed with the finger nail upon a piece of white paper, upon which a good seed leaves an oily stain.

If time permit the seeds may be actually germinated. The larger sorts, such as the oak seeds, are placed in vessels filled with earth, covered the proper depth, kept moist and at a temperature favorable to germination. Conifer seeds are placed between folds of flannel which are dipped into water kept at a medium temperature. There are also several forms of porous vessels made specially for such tests.

It is hoped that the descriptions given in the foregoing pages, together with the illustrations accompanying them, may be useful in calling public attention to the practical value of planted forests. In America the reforestation of denuded lands by artificial means—the formation of planted forests—is a question that sooner or later will confront our foresters. The student, on graduating from a forestry school, should supplement his course of study with a trip abroad in order to see the plantations there and the nurseries which are an indispensable adjunct to this particular system of forestry.

Birds as Conservators of the Forest

By F. E. L. BEAL.*

THE enemies of the forest may be roughly grouped in three categories — vegetable enemies, such as fungi and bacteria; invertebrated animals, mostly insects; and, lastly, vertebrates. These will include birds, mice, rabbits, etc., and, most destructive of all, man. Of the three groups, the second is by far the worst in its effects, and is the most difficult to combat. There is probably not a single species of land plant which does not have an insect enemy that preys upon it, and most of them have several, while the trees of the forest furnish food for a legion. In the Fifth Report of the United States Entomological Commission, over 400 species of insects are recorded as preying upon the oak, and the opinion is expressed that this number is far below what are actually in existence. In the same work the elm is said to have about 80 species which feed upon it, the hickory 170, the locust 41, the maples 100, the birch 105, the willow 186 and the pine 165, and in each case the list is confessedly incomplete.

On this point Dr. Hopkins has said:

“The results of investigations lead to the conclusion that the annual loss from insect work on forest trees, and their crude and finished products, amounts to at least one hundred million dollars.

“No period in the life history of a tree is exempt from insect attack, and every part, from the smallest roots to the terminal buds, leaves, flowers and fruit, may be infested by one or many species. The seed in the ground, the tender shoots of both roots and stems, and the young seedling, to the matured tree, may all be attacked by special enemies which injure or destroy different parts or the entire plant. In fact, living, diseased, dead, or decaying, a tree may be the home of hundreds of species and thousands of individuals of insect life.”†

From these considerations it may be seen at once how important any agency must be which will in any considerable degree reduce or restrain this great army of tree destroyers.

* Biological Survey, U. S. Dept. Agr.

† From Lecture on Forest Insects and Their Destructive Work; by Dr. A. D. Hopkins, in charge of Forest Insect Investigations, Bureau of Entomology, U. S. Dept. Agr.

Birds that Destroy Insects.

One very important means which Nature has provided for the restriction of these pests within reasonable bounds is found in the insect-eating birds, many species of which spend the most of their lives upon trees, and subsist upon the insects found thereon. The insectivorous habits of birds have been matters of common observation for centuries, but their scientific demonstration has been reserved for more modern times. The examination of birds' stomachs has shown that nearly all of the smaller species, and many of the larger ones, such as the crow, subsist largely upon insects in the summer time, while rearing their young, and, as a general rule, all the small birds feed their nestlings on this food no matter what the adults may eat. It is perhaps unnecessary to say that birds do not select their food with any special reference to the good or harm they may be doing to man, and those persons who expect to find in them a series of beneficent organisms wisely designed to do a certain amount of good and no harm are doomed to disappointment.

In the selection of their food, birds are either guided by their natural tastes or driven by a blind necessity, and it may be stated as a general rule that each species eats that kind of food which it finds by its own special method of foraging—that is, a flycatcher eats such insects as it catches in midair, and blackbirds and other terrestrial species such as they find upon the ground, while cuckoos, woodpeckers, and titmice gather their food mostly from trees. It does not follow, however, that birds eat all the insects which are found in their own peculiar haunts, but when they have a special method of their own they rarely abandon it for any other.

To what extent birds are guided by a natural taste in their selection of food is a point which is far from being settled. Whether a bird will pass by an abundant supply of insects in order to secure others that are more to its taste is a question which, aside from its biological interest, has an important bearing upon the economic side of ornithology. This problem can not be solved by stomach examination alone, but requires also patient and delicate field observation, combined with a thorough knowledge of the available food supply of the locality under consideration.

Some insects are supposed to be especially protected from birds by color, smell or taste, but stomach examinations have seemed to demonstrate that such devices are of but little use when brought in opposition to the keen senses and sharp appetites of their feathered enemies. The same method of investigation has shown that protective coloration is not so potent a factor in saving insects from

destruction by birds as many writers have supposed. Many species that have a disgusting odor, and rank, acrid taste, were formerly thought to be protected by these means, but it is found that these insects often form a very important percentage of the food of birds, and are eaten to some extent by nearly all insectivorous species.

In seeking for food, birds destroy useful insects as well as harmful ones; and while in many cases this is to be deplored, yet in the long run the birds are doing a good service by this indiscriminate destruction. Investigation and observation have furnished grounds for the belief that the true function of the insectivorous birds is to reduce the too crowded ranks of insect life as a whole, rather than to prey upon this or that particular pest, although this may be a very welcome service. If birds ate only harmful vegetable-eating insects, the predaceous species, which also prey upon them, would have their food supply reduced, and as it is well-known that many of them can and do feed to some extent upon vegetable matter, they might in their search for food attack some valuable products of the farm, orchard, or forest, and so in their turn become as great a pest as was their former prey. The woodpeckers feed largely upon woodboring grubs, the cuckoos and orioles subsist upon caterpillars, all of which are practically harmful insects, while the flycatchers prey to a great extent upon parasitic Hymenoptera, which would otherwise live upon the grubs and caterpillars, so that these groups of birds complement each other in their food habits, the one devouring the pests upon which the prey of the other would have subsisted.

While many birds belonging to various families gain their living largely from tree-infesting insects, there are some families of which every species practically lives upon trees, and subsist upon the insects or other food which they find there. At the head of these may be placed the family of woodpeckers (Picidae) and following these, but scarcely inferior in rank of usefulness, are the titmice (Paridae), the creepers (Certhiidae), the kinglets (Silviidae), the vireos (Vireonidae), and the wood warblers (Mniotiltidae). To these may be added certain species of wrens, orioles, flycatchers and swallows, of which many species subsist to a very considerable extent upon arboreal insects. In the following pages all references to the contents of birds' stomachs, unless otherwise stated, are based on examinations made by the writer.

THE WOODPECKERS.

Among birds which decidedly affect the welfare of the forest the family of woodpeckers probably takes the lead. Of these there are about forty-five species and subspecies that are found within the limits of the United States, all of which are of decidedly economic importance. The value of their work in dollars



Louis Agassiz Fuertes

RED HEADED WOODPECKER ADULT AND YOUNG



and cents is difficult of determination, but careful study has brought out much of practical importance by ascertaining approximately to what degree each species is harmful or helpful in its relation to the forests. Their subsistence is obtained for the most part upon trees, a mode of life for which they are specially adapted. The character of the feet and tail enables them to cling easily to upright trunks, and the structure of the bill and tongue gives them the power to cut into solid wood and withdraw the insects lodged within. The toes are in pairs, one pair projecting forward and the other backward, and are furnished with very strong, sharp claws, an arrangement which insures a firm hold upon the bark. The tail is



FIG. 1.—Tongues of woodpeckers: *a*, hyoid of flicker (*Colaptes auratus*); *b*, tip of tongue of downy woodpecker (*Dryobates pubescens*).

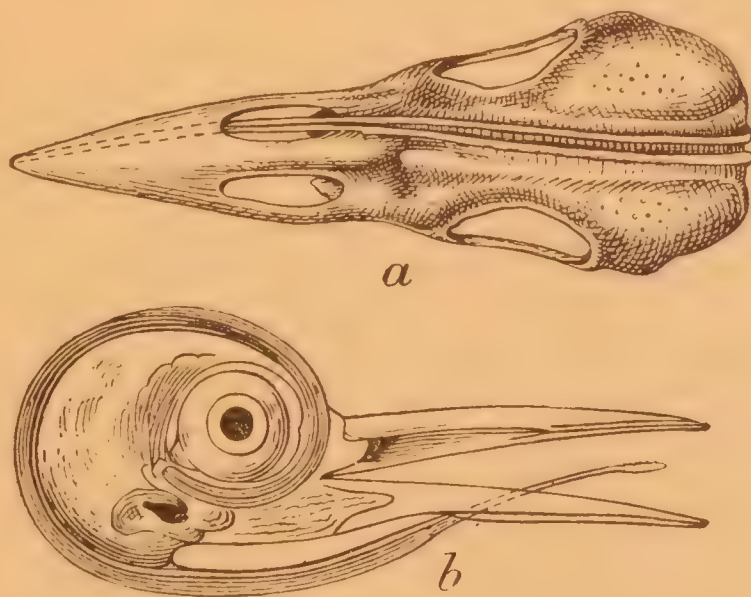


FIG. 2.—Special development of tongues of woodpeckers: *a*, skull of flicker (*Colaptes auratus*), showing root of tongue extending to tip of bill (after Lindahl); *b*, head of hairy woodpecker (*Dryobates villosus*), showing root of tongue curving around eye (after Audubon).

composed of very strong feathers, each with a sharp, stiff point at the end, which can be pressed against the tree trunk, and thus made to support and steady the bird. The beak is rather long, but stout, with a chisel-shaped point which is hardened and sharpened so as to render it a most effective wood-cutting instrument. The tongue, which is the most peculiar portion of the anatomy of these birds, is extended backward by two slender, flexible filaments of the hyoid bone, each incased in a muscular sheath (Fig. 1, *a*). These filaments, instead of ending at the back of the mouth, curve up over the back of the skull, across the top of the head, and down on the forehead (Fig. 2, *b*), and in some species enter the opening of the right nostril and extend forward to the end of the beak (Fig. 2, *a*). In the last case the tongue is practically twice as long as the head. By means of its sur-

rounding muscular sheath, the tongue can be protruded from the bird's mouth a considerable portion of its length, and can thus be inserted into the burrows of wood-boring larvae. In order to secure grubs or other insects, it is usually furnished with a sharp point and is barbed on the sides (Fig. 1, b). It is evident that a bird possessing such an apparatus must be capable of doing work which less advantageously endowed species can not accomplish. Hence, while most birds content themselves with eating such insects as they find upon the surface, woodpeckers seek those larvae or grubs which are beneath the bark, or even in the very heart of the tree. To render more effective the mechanism here described, these birds are gifted with a remarkably acute sense of hearing, by which to locate their prey within the wood. That they do so with great accuracy is proved by examination of their work, which shows that they cut small holes directly to the burrows of the grubs.

The name "sapsucker" has been applied to two or three of the smaller kinds of woodpeckers, in the belief that they subsist to a great extent upon the juice of trees obtained from small holes which they peck in the bark. There can be little doubt that one species, the yellow-bellied woodpecker (*Sphyrapicus varius*), does live to a great extent upon this sap. Observation does not show that other species have the same habit, but it is a difficult point to decide by dissection, as fluid contents disappear quickly from the stomach. The rings of punctures often seen around the trunks of trees are certainly the work of the sapsucker, though sometimes attributed to the downy and hairy woodpeckers. It is true, however, that woodpeckers sometimes do serious harm by removing large areas of the outer bark from trunks of trees, but this work has been definitely fixed upon the sapsucker alone. It is supposed that the object is to get at the mucilaginous layer called cambium, lying just inside of the bark, and from which both bark and wood are formed. Except in the case of this one species, stomach examination does not bear out this view, since cambium, if present at all, was in such small quantities as to be of no practical importance. The yellow-bellied woodpecker, however, is evidently fond of this substance, for the stomachs of this species were found to contain it in very considerable quantities. Moreover, as the true cambium is a soft and easily digested substance, it is probable that what is usually found in the stomach is only the outer and harder part, which therefore represents a much larger quantity.

Among the insects which enter into the diet of the woodpeckers the most important are the larvae of the woodboring beetles belonging to the families of longicorns (Cerambycidae), and the metallic woodborers (Buprestidae), with some woodboring caterpillars, the larvae of carpenter moths (Cossidae), or the clear winged moths (Sesiidae). During all seasons of the year these larvae constitute

a remarkably constant element of the food of most species of woodpeckers, which from their peculiar physical conformation are able to secure them though concealed in the solid wood, and in this way protected from the attacks of other birds. Stomach examinations show that with some species very few days pass when they do not get at least one meal of this kind of food. Besides these larvae many adult beetles of the same families are also taken, as well as others which prey upon trees, such as the engravers (*Scolytidae*) and some of the leaf-eaters (*Chrysomelidae*).

The ants are another family of insects that prey upon trees and do great damage. When a tree has been damaged by woodboring larvae, and these have been destroyed by woodpeckers, a colony of ants will generally occupy the vacant burrow, which they at once enlarge and extend till in course of time, as the colony increases, the whole trunk is riddled. Upon these the woodpeckers bring to bear the same tactics that were used in dislodging the woodboring grubs. The ants are dug out and devoured, and examination of the stomachs of many individuals of several species of these birds shows that they constitute a very considerable element of their food. Many stomachs contained nothing else, and, like the woodboring grubs, they form an almost daily article of diet. They are eaten in all stages—eggs, larvae, pupae, and adults, and all of these forms may sometimes be found in a single stomach.

Besides the direct injury which the ants cause to the trunks of trees, they are indirectly responsible for a good deal of mischief to the foliage done by the plant-lice (*Aphides*), which they distribute and protect. The relation of the ants to the plant-lice is quite like that of a dairyman to his cows. In fact, a French writer upon popular natural history has spoken of the ant as "the little black milkmaid, who pastures her green cows in the meadow of a rose leaf." This is a graphic, if somewhat fanciful, picture of the relations of ants and plant-lice, but unfortunately the black milkmaid does not limit her pasture to the rose leaf meadows. There are comparatively few plants which do not suffer to some extent from the ravages of plant-lice, and many forest trees seem to be especially subject to their attacks. Ants protect these lice from harm, and when the plant on which they are feeding is exhausted, carry them to fresh pastures and in some cases actually build shelters over them. Besides destroying the ants the woodpeckers eat many of the plant-lice.

Bark-lice, or scales (*Coccidae*), are also eaten quite extensively by the smaller species of woodpeckers, and as these creatures are very difficult to distinguish after they have been partially digested, it is probable that more of them are really taken than are credited to the birds. Many insects' eggs are eaten by the smaller woodpeckers, more especially those of the tent caterpillars (*Malacosoma*), which are found during the fall and winter months.

THE DOWNY WOODPECKER (*Dryobates pubescens*).

This little woodpecker is the smallest of all those inhabiting the United States. It is also one of the most familiar, being a frequent visitor to the shade trees about houses and parks, while its fondness for orchards is well known. It is, however, no stranger to the forest, where it often nests, and in the winter season may be frequently met in a mixed company of chickadees, creepers, nuthatches and kinglets, with whom it seems to be on the most amicable terms. It is moreover so quiet and unobtrusive in its movements that the first notice one has of its presence is perhaps a gentle tapping or scratching on the limb of a tree within one or two yards of one's head, where our diminutive friend has discovered a decayed spot inhabited by woodboring larvae or ants.

About 300 stomachs of this bird have been examined by the United States Department of Agriculture and found to contain about 75 per cent of animal food to 25 of vegetable. The animal matter practically consisted entirely of insects and their allies, and was made up of beetles, both adult and larval, ants, bugs, flies, caterpillars and grasshoppers, with a few spiders and myriapods. The relative proportions of these elements, however, differ widely. Beetles and their larvae constitute nearly one-third of the animal food—24 per cent—and the greater part of these were woodboring species or those which are acknowledged to be the worst enemies to forest trees. Cerambycid and Buprestid larvae, as well as the engraver beetles (Scolytidae), are such constant elements of the food that they were found in almost every stomach, and in some were the only contents. If to these we add the caterpillars (16 per cent of the whole food), all of which were tree feeders, and most of them borers, we have the total of 40 per cent, or over half of the animal food, made up of these enemies of the forest. The American tent caterpillar (*Malcosoma americana*), a notorious pest to both orchard and forest trees, was found in many of the stomachs. Some other beetles besides the woodborers are also eaten by the downy woodpecker. Over 50 specimens of *Dorytomus mucidus*, one of the snout beetles or weevils, and a species which subsists on trees, were taken from one stomach.

Ants enter the diet of the downy to nearly the same extent as beetles, viz, 23 per cent of the entire food. These are largely species of the genus *Camponotus*, which inhabit the interior of the more or less solid wood, and constantly enlarge their quarters by extending their galleries in all directions. Other of the species upon which they feed are those that protect and care for the plant-lice, with many that get their living in various ways.

Bugs (Hemiptera) are represented in the downy's diet by several families, but



NORTHERN HAIRY WOODPECKER, MALE



most notably by plant-lice and scale insects. The former constitute 4 per cent of the year's food, but as they can only be found during the warmer portion of the year, they amount to quite a considerable percentage of the food for those months. Moreover, it must be borne in mind that these soft-bodied creatures are so soon reduced to an unrecognizable pulp in the stomach it is probable that many more are eaten than were positively identified. Scale insects (Coccidae) were also eaten, and several stomachs were entirely filled with them, but like the plant-lice, they are difficult to determine after digestion has somewhat progressed, so that it is probable many were overlooked.

THE HAIRY WOODPECKER (*Dryobates villosus*).

The hairy woodpecker is as common as the downy in most parts of the United States, and to the ordinary observer is only to be distinguished by its greater size, as its colors and markings are very nearly the same. The hairy is a noisier bird, however, and usually makes its presence known by loud calls and other obtrusive behavior, such as rapid flights from tree to tree. Besides the general resemblance of the two birds there is also a remarkable similarity in their food habits, as shown by the contents of their stomachs. The greatest difference is that the hairy eats a somewhat smaller percentage of ants than does the downy. From an examination of 172 stomachs the relative proportions of animal and vegetable food were found to be about 74 per cent of the former to 26 of the latter.

Beetles, both adult and larval, constitute 24 per cent of all the food, or more than one third of the animal matter. As is the case with the downy, these beetles are mostly woodboring species dug out of the solid wood by the sharp chisel of the bird. Larvae of both the great woodboring families Cerambycidae and Buprestidae were identified in most of the stomachs. From one stomach 1 adult and 70 larval Cerambycids were taken; from another, 100 larvae; and 50 and 25 respectively were taken from two others. These are samples of what this bird is doing in the work of forest preservation. But it also eats other beetles which prey upon the trees; 109 individuals of *Dorytomus mucidus*, the snout beetle, that was eaten so freely by the downy, were found in one stomach of the hairy, with 63 in another and less numbers in several others. Another interesting insect found in the stomach of this bird was *Polygraphus rufipennis*, a destructive enemy of the pine tree. Another stomach contained several specimens of *Tomicus caelatus*, another pest of the forest.

Caterpillars amount to 21 per cent of the diet of the hairy woodpecker, and are mostly of the woodboring species, and are all enemies to forest trees. Ants do

not constitute so large an element of food with this bird as they do with the downy. Only 17 per cent were found as a total of the year's consumption, but these were mostly of the genus *Campanotus*, which lives in the more or less decayed parts of trees, from which the woodpeckers can alone dislodge them. Plant-lice and scales were found in a few stomachs, and in several the latter constituted the whole contents.

One point to be especially noted in regard to the food habits of the two birds just considered is that the relative proportion of animal and vegetable foods in their diet varies but little from month to month throughout the year. Most birds that live on the same range through the whole year are found to subsist on insect food during the warmer months, but in winter, when these are not easily obtained, they change to a vegetable diet, such as seed, mast, etc. This, however, is not the case with the two birds under discussion. While the animal food which they consume does vary to some extent from month to month, there is no decided increase in the warmer season or decrease in winter. This is evidently owing to the fact that so large a proportion of the food consists of woodboring larvae, which can be found in their burrows at all seasons, and which the birds prefer to dig out rather than subsist upon other food which may be more abundant or more easily obtained. It is this very marked preference for wood boring larvae, shown by the amount of hard labor they are willing to undertake in order to get them, that gives these birds their great value as conservators of the forest.

THE THREE-TOED WOODPECKERS (*Picoides arcticus* and *P. americanus*).

The two species of three-toed woodpeckers are so much alike in their food as well as in their general habits that they may be considered together, as they eat almost identically the same food and in the same proportions. They are both found only in the northern portions of the country. They breed to some extent in the northern tier of New England States, and some of those farther west, but even there they are most abundant during winter. They are eminently forest-haunting birds, and live in and gain their livelihood from trees. Like the hairy and downy woodpeckers, their principal food consists of wood-inhabiting coleopterous and lepidopterous larvae—that is, grubs and caterpillars that bore into trees and fallen logs.

An examination of a number of their stomachs shows that more than nine-tenths of their food consists of animal matter, and that more than four-fifths of this is made up of these destructive woodborers. The remainder is composed of ants, a few engraver beetles and some scales. As with the hairy and downy woodpeckers,



Wm. Brewster

WHITE BACKED THREE TOED WOODPECKER.
UPPER FIGURE FEMALE. LOWER FIGURE MALE.

THE REDHEADED WOODPECKER (*Melanerpes erythrocephalus*).

The redhead is a common bird in suitable localities throughout the United States east of the Rocky Mountains, but is only casual in New England. It is not so much of a forest lover as some of the other woodpeckers, preferring to keep on the outskirts rather than in the depths of the woodlands. It is a familiar object on telegraph posts and dead trees, and seems to prefer these apparently rather barren hunting grounds to more fruitful fields. The character of its food, however, shows that it is largely taken upon these bare surfaces, or, as has been observed, caught in mid air.

Examination of many stomachs of the redhead shows that its food is composed of about 52 per cent of animal to 48 per cent of vegetable matter. While all of the more common orders of insects are eaten to some extent, beetles are evidently the favorite food, as they constitute nearly one-third of the whole. Unlike the downy, hairy, and three-toed woodpeckers, however, the redhead takes most of its beetles in the adult stage. Many of them belong to the May beetle family (Scarabaeidae), with representatives of several others. It seems to be a prominent characteristic of this bird to prefer large insects for its prey, such as the dor-bug (*Lachnosterna*), the June bug (*Allorhina nitida*), and the fire ground beetle (*Calosoma calidum*), a predaceous beetle of large size and vile odor. *Passalus cornutus*, a large species that lives in rotten wood, was also found in some of the stomachs, and a pair of mandibles belonging to *Prionus brevicornis*, one of the largest beetles in the northern United States. This last is a very destructive forest insect, as its larvae lives in the trunks and roots of certain trees, and being of enormous size its burrows are a great damage to the timber. Weevils were found in many stomachs, and as many as ten were contained in one. The rest of the food consists of ants, which constitute eleven per cent of the food, with a few bugs, grasshoppers, caterpillars, etc. The redhead eats fewer ants than any of the foregoing species, as these insects are not so often found on the bare poles which the bird so persistently haunts.

THE FLICKER (*Colaptes auratus*).

Three species of the genus *Colaptes*, with several subspecies, are found within the limits of the United States. Their differences in form, size and plumage are not remarkable, and their variations in diet are still less noticeable—in fact, whatever may be said of the food of one may be said of all, making due allowance for differences in the available food supply of various localities.



Flicker, Male



The Eastern form, commonly known as the flicker, or golden-winged woodpecker, is one of the largest and best known of our common woodpeckers, and is more migratory than either the downy or hairy. In winter it is absent, or at least very scarce, on its breeding range in the Northern States, where it is abundant in summer and early fall. In most places it is a much shyer bird than any of the preceding, and while it frequents the farm, and comes about the buildings freely, it keeps more in the tops of the trees, and does not allow so near an approach of its greatest enemy—man. It is the most terrestrial of all the woodpeckers, in spite of its high-perching and high-nesting proclivities, and may often be seen walking about in the grass like a meadow lark.

From the examination of over 400 stomachs of the flicker, it has been found that its food consists of approximately sixty per cent of animal matter and forty per cent of vegetable. The animal matter is made up of ants, beetles, bugs, grasshoppers, crickets, caterpillars, May flies and white ants. Three fourths of this, or forty-five per cent of the whole, consists of ants. No North American bird has yet been investigated whose record for eating ants is equal to this. Quite a number of the stomachs were entirely filled with these insects, and in many, even where there was other food, more than a thousand of them were found. The contents of three stomachs were carefully counted, and two of them were found to contain over 3,000 each and the third over 5,000 of these creatures. A large part of the ants eaten by the flicker are the small species which live in burrows in the ground, but many of the wood-boring species are also taken. Another interesting insect found in the flicker's stomach is the white ant (*Termes flavipes*). While this insect has no natural relationship to the ordinary ant, it very much resembles it in its habits, often inhabiting rotten logs, and sometimes living in and injuring living trees. It also bores into timber in buildings.

Beetles constitute about 10 per cent of the flicker's food, and a much larger proportion of them are adults than is the case with the preceding species. Still it does eat some of the wood-boring larvae, which it obtains from the tree, where the wood is not too hard. May beetles (*Lachnosterna*) and their allies were found in several stomachs, as were also a few predaceous ground beetles (*Carabidae*), and some larvae of tiger beetles (*Cicindelidae*). The two last, taken in connection with the ants and a few grasshoppers which had been eaten, emphasize the terrestrial habits of the species.

The vegetable portion of the flicker's food is larger and more varied than that of any of the foregoing species, but this part of the woodpecker's diet will be taken up and discussed on another page.

It is unfortunate that the flesh of the flicker is very palatable, so that in many places they are considered as a game bird, and slaughtered accordingly. When the wild black cherries (*Prunus serotina*) are ripe, they form a favorite food for the flickers, as well as for many other birds, and at such times they are so busy in the cherry trees that they seem to lose their customary shyness, and are easily approached and shot. Before the game laws were made so stringent, thousands of flickers were annually shot for food in the northeastern portion of the country during the last of August and September. This is now to some extent prevented, and should be wholly suppressed.

THE YELLOW-BELLIED WOODPECKER, OR SAPSUCKER.

This species is probably the most migratory of all our woodpeckers. In the United States it breeds only in the most northerly parts, and in some of the mountains farther south. In the fall it ranges southward, and in the winter is found in most of the Gulf States and beyond. It is not so generally distributed as most of the other species, being quite unknown in some districts, while it is very abundant in others. Dr. C. Hart Merriam states that in the Adirondack region during migration it outnumbered all other species of the family together, and in summer is second in numbers only to the hairy woodpecker. At Mount Chocorua, in New Hampshire, Mr. Frank Bolles found it the most abundant species. In Minnesota, also, it is very common, while on the other hand in Massachusetts and Iowa it is comparatively rare.

It is to this species that the term "sapsucker" is most often and most justly applied, for it drills holes in the bark of certain trees and drinks the sap. It also feeds on cambium, insects, wild fruit and berries.

In writing of the woodpeckers of this species in northern New York, in 1878, Dr. Merriam states:

"They really do considerable mischief by drilling holes in the bark of apple, thorn apple and mountain ash trees in such a way as to form girdles of punctures, sometimes 2 feet or more in breadth (up and down) about the trunks and branches. * * * The holes, which are sometimes merely single punctures, and sometimes squarish spaces (multiple punctures) nearly half an inch across, are placed so near together that not unfrequently they cover more of the tree than the remaining bark. Hence, more than half of the bark is sometimes removed from the girdled portions, and the balance often dries up and comes off. Therefore it is not surprising that trees which have been extensively girdled generally die, and mountain ash are much more prone to do so than either apple or thorn apple



YELLOW-BELLIED Sapsucker
F. P. 120. June 1891. F. P. 120.



trees, due, very likely, to their more slender stems. The motive which induces this species to operate thus upon young and healthy trees is, I think, but partly understood. It is unquestionably true that they feed, to a certain extent, both upon the inner bark and the fresh sap from these trees, but that the procurement of these two elements of sustenance, gratifying as they doubtless are, is their chief aim in making the punctures I am inclined to dispute. As the sap exudes from the newly made punctures, thousands of flies, yellow-jackets and other insects congregate about the place, till the hum of their wings suggests a swarm of bees. If, now, the tree be watched, the woodpecker will soon be seen to return and alight over the part of the girdle which he has most recently punctured. Here he remains, with motionless body, and feasts upon the choicest species from the host of insects within easy reach. * * * In making each girdle they work around the trunk, and from below upwards, but they may begin a new girdle below an old one. They make but few holes each day, and after completing two or three remain over the spot for some little time, and as the clear fresh sap exudes and trickles down the bark they place their bill against the dependent drop and suck it in with evident relish—a habit which has doubtless given rise to the more appropriate than elegant term sapsucker, by which they are commonly known in some parts of the country. I have several times watched this performance at a distance of less than 10 feet, and all the details of the process were distinctly seen, the bird looking at me meanwhile ‘out of the corner of his eye.’ When his thirst is satisfied he silently disappears, and as silently returns again after a few hours, to feast upon the insects that have been attracted to the spot by the escaping sap. This bird then, by a few strokes of its bill, is enabled to secure both food (animal and vegetable) and drink in abundance for an entire day; and a single tree, favorably situated, may suffice for a whole season.”*

The late Frank Bolles has published some interesting detailed observations respecting the food habits of the sapsucker. His conclusions are:

“That the yellow-bellied woodpecker is in the habit for successive years of drilling the canoe birch, red maple, red oak, white ash, and probably other trees, for the purpose of taking from them the elaborated sap, and in some cases parts of the cambium layer; that the bird consumes the sap in large quantities for its own sake and not for the insect matter which such sap may chance occasionally to contain; that the sap attracts many insects of various species, a few of which form a considerable part of the food of this bird, but whose capture does not occupy its time to anything like the extent to which sap drinking occupies it; * * * that the forest trees attacked by them generally die, possibly in the second

* Bull. Nuttall Ornith. Club, Vol. IV, January, 1879, pp. 3-5.

or third year of use; that the total damage done by them is too insignificant to justify their persecution in well-wooded regions."*

In a subsequent article Mr. Bolles gives the results of an attempt to keep several young sapsuckers alive on a diet of diluted maple syrup. Unfortunately for the success of the experiment, the birds obtained and greedily devoured many insects that were attracted to the cage by the syrup. How many insects were eaten was not known, but all of the birds died within four months. Examination of their bodies showed fatty degeneration of the liver—a condition said to be usual in cases of starvation. Mr. Bolles has thus proved that concentrated sap (saturated with sugar) is not sufficient to sustain life, even with a small percentage of insects. The natural inference is that sap, while agreeable to the birds, and consumed in large quantities, holds but a subordinate place as an article of food.

The examination of the stomachs of quite a number of yellow-bellied woodpeckers shows that they eat animal and vegetable food in about equal proportions. The animal food consists of ants, beetles, flies, bugs, grasshoppers, crickets, May flies and spiders. Ants amount to thirty-six per cent of the whole, a greater record than that of any other woodpecker except the flicker. The other insects do not appear in any remarkable quantities, so that it is as an ant eater that this bird does the greatest good. It is here, if anywhere, that it compensates for what harm it commits in girdling trees. In this last respect, however, it is doubtful if the bird ever inflicts any very appreciable damage upon a natural forest. In these, trees are usually superabundant, and the few that are killed only give a better chance for those that remain.

Another point, to which Dr. A. D. Hopkins has recently called attention, is the fact that the wounds made in the bark or cambium of trees by the beak of this bird, while sometimes resulting in injury or death to the tree, at other times leads to certain distortions of the grain in future growth which gives a variegated appearance to the polished surface of the timber when used, and often very much enhances its beauty. As the wounds heal over the new layers of wood are either elevated or depressed at the point where the wounds were made, and when the logs are cut into boards the appearance of what is called "bird's-eye" is produced, or if a radial cut is made we have the "curl." These effects resemble very closely the bird's-eyes and curls which are produced naturally in maple and some other woods, but are usually less in numbers in a given area.

* The Auk, Vol. VIII, July, 1891, p. 119.



Roux Agassiz Puertes.

BLACK-BACKED THREE-TOED WOODPECKER.
UPPER FIGURE FEMALE. LOWER FIGURE MALE

THE GREAT PILEATED WOODPECKER (*Ceophloeus pileatus*).

This bird, variously known as the log cock, cock of the woods, or pileated woodpecker, is the largest of the family now found within the limits of the United States, with the single exception of the ivory-billed woodpecker, which is very rare. It is essentially a bird of the forests, and is only found where there are rather extensive tracts of timber. It is a shy, retiring bird, difficult to approach, and, where not abundant, is better known by its work than by sight of the bird itself. Its large size, loud voice, and habit of hammering upon dead trees, render it conspicuous, however, at a considerable distance. Its strength is wonderful, and one unacquainted with it can scarcely credit a bird with such powers of destruction as is sometimes shown by a stump or dead trunk on which it has operated for ants or boring larvae. I have seen strips of wood two feet in length and four inches wide, by one inch thick, torn from a stump, and thrown several yards away by this bird. It is a well known fact that various species of woodpeckers have a way of signaling to each other by hammering upon a dead tree or branch, or any other resonant body, such as the metallic cornice of a building, as has been sometimes observed. The pileated woodpecker is an adept at this method of telegraphing, and once gave the writer an exhibition of skill in this respect which will long linger in his memory. It was toward the close of a sultry afternoon among the mountains of Virginia, and a thunder shower was rapidly approaching. The sky was all overcast, and it was as dark as twilight, though the sun was several hours above the horizon. The wind had died away, every leaf hung motionless, and, except for an occasional low mutter of thunder, not a sound could be heard. Suddenly from near the top of a ridge came the loud, sharp rub-a-dub-dub of the great woodpecker drumming on a dead chestnut stub. Immediately came the answering drum of another half way down the slope, then another from farther along the ridge, then from across the valley, and so on until at last a dozen performers were calling and answering to each other in turn, until the downpour of the shower put a stop to the whole.

The food of the pileated woodpecker is nearly evenly divided between insect and vegetable matter. The former consists of beetles and ants, with a few of some other orders. The beetles are mostly taken in the larval stage, and are nearly all wood-boring species. Even those that are eaten in the adult form are of the same species as the larvae. The ants are all of the large species that infest wood, decayed or otherwise. All of the insects taken are such as are found in the forests where these birds feed almost exclusively.

The scarcity of this species in most parts of the country renders it such an object of curiosity that it is usually shot on sight by hunters or by anybody who happens to have a gun with him. This should not be allowed. The bird is not fit for food, and there is no possible use to which its body can be put after its death, while when alive it is one of the most valuable conservators of the forest.

THE TITMICE (Paridae).

The titmice are mostly small, plain-colored birds, with but little attempt at ornamentation beyond a crest or tuft of feathers upon the head, which can be raised or lowered at will. Their colors are, for the most part, black and white, with some brown and plain gray. While they may often be seen in groves and orchards, and even on wayside trees, they are by nature inhabitants of the forests. This is more especially true of the Eastern species, most of which are nonmigratory, and in winter time may be met in loose flocks rambling through the woods, every one busy searching the trees for food, and at short intervals giving his call note, which enables the company to keep together. At such times there will usually be a few birds of other species with them, notably the downy woodpecker, the brown creeper and one or both of the common species of nuthatches. This is not entirely a case of birds of a feather flocking together, but of birds of similar food habits banded for a common purpose. Community of taste in the matter of diet, and the method of obtaining it, is evidently the bond which holds these different species together.

If one will watch these tiny creatures as they flit from tree to tree, he will wonder that anything suitable for food can escape their prying eyes. When one of them alights upon a tree it at once begins a minute investigation of the trunk and limbs, paying particular attention to every place, such as a knothole or a decayed spot, where any insect might be concealed or where its eggs might be laid. In doing this it swings itself under horizontal branches, runs up the perpendicular trunk, or stands head downward while it examines a particularly promising spot. It searches every crack in the bark, peeks under every bit of moss or lichen, and, if it be the time when the leaf-buds are beginning to swell, it will peer into every one in search of the newly hatched caterpillar, which it literally "nips in the bud."

The birds of the titmice family, though insignificant in size, are far from being so in the matter of their food habits. What they lack in size of body they more than make up in numbers of individuals. While in the case of some of the larger birds—as, for instance, the flicker—there is one pair of eyes to look

for food for one large stomach, we have in the ten times as numerous titmice an equivalent stomach capacity divided into ten parts, and each portion furnished with a pair of eyes and other accessories, such as wings and feet. As against the one place occupied by the larger bird, ten are being searched for food at the same time by the lesser ones. It is evident that this arrangement is more effective in the destruction of the smaller species of insects than the plan of a single large bird.

The character of the food of the titmice gives a peculiar value to their services, for it consists largely of the smaller insects and their eggs, objects which either escape the search of the larger birds or are too insignificant to be considered worthy of notice. Among the prominent elements of food which the titmice find in their inspection of the trees in the winter are hibernating insects and their eggs. A great many species pass through this cold season in the shape of eggs, and thousands of these come to an untimely end in the stomach of these minute birds. Others spend the winter in the larval or pupal state, still others hibernate in the adult form, but unless buried beyond reach they are dragged forth from their places of concealment and devoured.

There are within the boundaries of the United States seventeen species, with several subspecies, of titmice, all of them inhabitants of the forests and foragers upon trees. Comparison of the food of the various species shows that it is of the same general character for all, but that the particular kind of insects which are eaten varies somewhat with the geographical range of the bird. But whatever insect may be chosen it is nearly always some species that preys upon the foliage, flowers, or fruit of some tree or shrub. Nearly one thousand stomachs of different species and subspecies of titmice have been examined, and the result of careful analysis has confirmed the observations made in the field and proved beyond question that this family of birds is one of the most efficient conservators of the forest.

The common black-capped chickadee is abundant over the northern portion of the country, as far south as the Potomac and Ohio rivers in winter, and remains in one or two of the most northerly tiers of States during the whole year. With its two subspecies it extends entirely across the continent from ocean to ocean. In June the food of this species consists almost entirely of insects, and in winter this part of the food sinks only to about forty-two per cent of the whole, which is a large percentage for the cold months. Caterpillars and a few moths, with many of their eggs, constitute one third of the entire food, and the consumption of these during the winter months is but little below the average for the year. This shows that these birds do not in vain search the trunks and branches of

trees—that they do find the eggs and hibernating insects which are concealed in the crevices and cracks, and destroy them. Besides caterpillars, the titmice also eat some beetles, ants and bugs, with quite a number of spiders. The insects' eggs taken by them consist largely of those of the two species *Malacosoma*, or tent caterpillars, in the region where they are to be found. The beetles eaten are of the smaller species of leaf-eaters (*Chrysomelidae*), the engraver beetles (*Scolytidae*) and other weevils or snout beetles, especially the genus *Balaninus*, which lays its eggs in acorns and other nuts, where the grub feeds and destroys the seed. At times they find and destroy the beetles that are the parents of the woodborers—that is, the *Cerambycidae* and *Buprestidae*. Bugs are represented in the stomachs by a few stink bugs (*Pentatomidae*), but more especially by the bark scales (*Coccidae*). The larger species, belonging to the genus *Lecanium*, are evidently a favorite food, as they are found in many stomachs. The black olive scale (*L. oleae*), which infests many kinds of trees besides the olive, is especially abundant on the Pacific coast, and is freely eaten by that pigmy of the family, the California bush tit (*Psaltiriparus minimus californicus*). Other scales, however, are frequently eaten. Plant-lice and their eggs are also found in the stomachs, the latter occurring in the winter months.

THE NUTHATCHES (*Sitta carolinensis* and *S. canadensis*).

The nuthatches are, like the titmice, lovers of the forest, and like them they do not disdain to visit parks and orchards, and may occasionally be seen scrambling over the trees in the dooryard. As acrobats they are unsurpassed; the woodpeckers, the titmice and the creepers will run up a tree with ease and skill, but they will not try to run or walk down the trunk as the nuthatches do, nor can they walk along the under side of a horizontal branch with that apparent disregard for the attraction of gravity that the fly displays when on the ceilings. But this is an ordinary matter to the nuthatches. They walk down a tree trunk, or around it, or on the under side of a branch, and stop with their body hanging downward, while they inspect a knothole, apparently not in the least inconvenienced by this upside-down position. Nor when pecking at anything which they think may promise food do they rest upon their tails as do the woodpeckers, but, held in place by the clutch of their sharp claws, they stand and work at perfect ease. Four species and three subspecies of nuthatches are found within the limits of the United States. They all belong to the same genus, and vary but little in general appearance, or in their food habits, and the two whose names stand at the head of this chapter may be taken as types of all.



RED-BREASTED NUTHATCH
UPPER FIGURE—MALE; LOWER FIGURE—FEMALE

It is almost unnecessary to say of these birds that their food is made up of precisely the same element as that of the titmice, but somewhat varied in the proportions of each. Like them they eat a great many caterpillars, and the eggs from which caterpillars would be hatched. Small beetles, ants and bugs are also favorite food. Scales and "spittle insects" (Cercopidae) are some of the enemies to trees of which they appear to be very fond. The particular species of these last which they eat are probably those that feed upon the pine, as most of the stomachs in which they were found were taken in a pine forest. Of the nuthatches Dr. Coues has said: "In their relation to man, these birds are heedless and familiar, as if they trusted to his good will in return for the valuable services they render him in destroying incalculable numbers of noxious insects—a confidence too often abused by the vulgar and ignorant, who harbor against them the same prejudice that exists against the sapsucker (*Sphyrapicus*), the innocent and industrious nuthatches being supposed to injure trees, when the fact is they spend the whole of their laborious lives in man's service."*

THE BROWN CREEPER (*Certhia familiaris americana*).

This diminutive bird is one of the companions of the titmice in their winter foraging parties, and appears to go with them merely for the sake of their company, as its chance for food would evidently be better if alone. Like the titmice, it gets its food upon trees, and eats practically the same things, but hunts upon trunks of trees rather than on the branches. It almost invariably alights upon the tree near the ground and then runs spirally upward, sometimes to near the top, at others only half way or less, and then wings its way to another. It is very much of a forest bird, where for the most part it feeds and nests, but it will occasionally visit an orchard or park in the winter season. The geographic range of the creeper corresponds in a general way with that of the black-capped chickadee.

It might be inferred from ordinary field observation that the food of this bird would very closely resemble that of the titmice, as they hunt in the same places and in nearly the same manner. This inference is confirmed by stomach examination, which shows that the food of the two birds is almost identical, and that whatever may be said of the food of the titmice may also be said of that of the creeper. The insects eaten are those which prey upon the foliage, flowers and fruit of trees, as well as some that bore into the trunk or branches and do much harm thereby.

* Birds of the Colorado Valley, p. 133.

There is no better description of the working habits of this bird than that given by Dr. Coues:

"The leading trait of the Brown Creeper is its extraordinary industry — the 'incomparable assiduity,' as it has been well styled, with which it works for a living. Like all good workers, the Creeper makes no fuss about it, but just sticks to it. So quietly, yet with such celerity, does it go about its business that it scarcely seems to be at work, but rather to be rambling in an aimless way about the trunks of trees, or at most only caring to see how fast it can scramble to the top. During all this time, however, the bird is on the alert in the search for insects, which it extracts from their lurking-places with such dexterity that its progress is scarcely arrested for a moment; and the number of these minute creatures yearly destroyed is simply incalculable."*

THE WARBLERS.

The wood warblers, or, as they are usually called in America, the warblers, simply, are a large family of small birds noted for the brilliancy of the plumage of many species, and for the sweetness of their song. They are peculiarly American in distribution and in most cases are inhabitants of forests. The majority of the species obtain their food from trees and shrubs, but a few are more terrestrial and feed largely upon the ground. There are within the limits of the United States fifteen genera, with about fifty-nine species and eighteen subspecies of this family, and there are few areas of any considerable size that do not have their complement. They are as a family very small, many of them being no bigger than the common house wren, and the largest ones only exceeding the bluebird by a trifle.

There can be no finer tribute to the usefulness of this family than that of Dr. Elliot Coues, who says:

"With tireless industry do the warblers befriend the human race; their unconscious zeal plays due part in the nice adjustment of Nature's forces, helping to bring about the balance of vegetable and insect life, without which agriculture would be in vain. They visit the orchard when the apple and pear, the peach, plum and cherry are in bloom, seeming to revel amid the sweet-scented and delicately-tinted blossoms, but never forgetting their good work. They peer into the crevices of the bark, scrutinize each leaf, and explore the very heart of the buds, to detect, drag forth and destroy those tiny creatures, singly

* Birds of the Colorado Valley, p. 147.



Louis Agassiz Suertes.

BLACK-THROATED VIREO
TWO-YEAR OLD MALE, LIVING IN THE WOODS



insignificant, collectively a scourge, which prey upon the hopes of the fruitgrower, and which, if undisturbed, would bring his care to naught."*

The food of the warbler, with the exception of the few ground-feeding species, consists of such insects as are found upon the trunks, branches, leaves and flowers of trees, mostly those of the forest, though many species of these birds visit the orchard for food, and sometimes nest there. As might be expected, small beetles, ants, and caterpillars, with some scales and plant-lice, make up the bulk of the food of the tree-feeding species. The three elements which appear most prominently in the stomachs are beetles, ants and caterpillars. These are remarkably constant elements of the food, and are found in most of the stomachs examined. The beetles are largely of the family of snout-beetles (Rhyncophora), all of which are injurious to some plant, and many of them to forest trees. To show the capacity of some of these small birds, the contents of several of their stomachs may be cited. No. 1 contained 68 weevils, some scales, a pupa case and a spider. No. 2 contained 65 weevils, with a few other insects. No. 3 had at least 53 weevils, with fragments of others, and some other insect. No. 4 contained 50 weevils, with remains of others, a leafhopper and some ants. No. 5 was filled with 35 weevils, remains of Hymenoptera (wasps), caterpillars, a pupa case and a spider. These five birds had eaten altogether 271 of these injurious weevils, and from the broken remains contained in their stomachs it is highly probable that 300 is much nearer the true figures. In another stomach were found 52 specimens of another beetle, with remains of other insects.

While the different species of the warbler family show some peculiarities in the selection of their food, there is still a pronounced similarity in the elements selected by all those whose haunts are the same. The species that live upon trees, which constitute a majority of the family, not only show the same tastes in diet, but also strongly resemble in this respect the birds of other families that live and obtain their food in the same places. Thus the food of the warblers is strongly suggestive of that of the titmice, the nuthatches, the creepers and the kinglets.

A single instance may serve to illustrate the kind of work done by this family of birds. The spring of 1900 was remarkably cold and backward in the Northeastern States, and a multitude of birds had migrated as far north as Massachusetts, but were held from going farther by the cold and snow which still lay upon the ground in New Hampshire and northward. In the meantime, owing to the cold northerly winds, the insects were slow to come from their hiding-places, so that the birds

* Birds of the Colorado Valley, p. 201.

were in some straits for food. At this time the apple trees had advanced so far that the end of every twig presented a rosette of slightly expanded leaves, often enclosing undeveloped flower buds. A flock of warblers composed of several species was one morning observed by the writer flitting from tree to tree in an orchard, and examining each of these rosettes. So silent and industrious were the birds that they paid no heed to the observer, but kept at their work even when only a yard or two from his head. In order to determine what food these birds were finding on the trees, a number of the rosettes were examined upon a tree at some distance ahead of the birds, and each one was found to contain from one to half a dozen large green plant-lice (Aphides). These insects were large, full grown, and ready not only to suck the juice from the leaves and flowers, but to bring forth a numerous progeny to prey upon the further growth of the trees. But the birds came just at that time when by destroying the mother insect they not only prevented her from doing further harm herself, but cut off the future generations which would have continued in a steady succession all summer. This work was observed on several days, and probably was continued until the warmer weather brought an abundance of insect food.

THE KINGLETS (*Regulus satrapa* and *R. calendula*).

These two minute birds may be considered as titmice in disguise, for as far as actions are concerned they are the complete counterparts of those restless birds. They have the same tireless industry, the same unending search for insects in the crevices of bark, under leaves, in buds or tufts of moss. Perhaps they do not as a rule frequent such large trees as the titmice, but rather prefer small trees or shrubs, but still they are forest inhabitants, and are to be found where large trees are the principal growth. In color they are decidedly more stylish than the titmice, in so far at least as their head dress goes, which consists of a particularly jaunty cap of bright colored feathers, golden in one and ruby-colored in the other—hence their two common names, the golden-crowned and the ruby-crowned.

Their food is mostly composed of insects, with only a small percentage of vegetable matter. An examination of several hundred of their stomachs shows that the insects eaten are mostly small beetles, particularly weevils, ants, bugs (Hemiptera), and small caterpillars, with a few of other orders. The first three of these, however, make up the great bulk of the food. In the case of the ruby-crowned kinglet (*Regulus calendula*), ants, with a few other Hymenoptera, amount to more than thirty-six per cent of the whole food of the year, and are an



MOURNING WARBLER,
UPPER FIGURE FEMALE. LOWER FIGURE MALE

important element in every month. Hemiptera constitute nearly thirty per cent of the food, and are composed mostly of plant-lice and scales, which are eaten at all times when they can be found, and the scales can be obtained in every month, as they pass the winter on the bark in a dormant state, or in the shape of eggs. Beetles are eaten to the extent of eighteen per cent of the food, and are nearly all injurious species. All of the above insects are of the smaller species, such as larger birds are apt to pass by, yet some of the worst enemies of forest trees are found in these minute creatures. As a sample of what one of these little birds can do in the way of devouring insects, the following account of a stomach contents of *Regulus calendula* may serve. The principal item consisted of the remains of something over 100 small beetles, *Notoxus alamedae*, with several others of the genus *Anthicus*, a few Chrysomelids (leaf-eating beetles), some Scolytids (engraver beetles), one Scymnus and one beetle too badly mangled for recognition. All of these are harmful insects except the last two, and the unknown one might have been.

THE CUCKOOS (*Coccyzus erythrophthalmus* and *C. americanus*).

Cuckoos are quiet birds and rather retiring in their habits. Their notes, though frequently heard in warm weather, are not loud or obtrusive. However, they do not avoid the haunts of men, but have a way of concealing themselves amidst the foliage, and shunning naked branches or exposed places, so that they are not often seen. Their favorite resorts are the open groves or woods, the edges of forests, orchards, and clumps of trees and shrubs. They often visit the shadetrees about farmhouses, and are frequently heard in the trees along village streets, or even in city parks.

While there are three species and two subspecies of these birds in the United States, only two are abundant enough to become of economic importance. These, with one subspecies, practically occupy the whole country except the plains and deserts, but in winter are found only in the extreme southern portion of their range. The yellow-billed cuckoo (*Coccyzus americanus*) breeds from the Gulf of Mexico to southern Canada; the black-billed ranges still farther northward. The migration does not begin until spring is well advanced, and on the return movement most of the species leave the Northern States in August, though a few linger a little longer. Their northern season is therefore comparatively short, a peculiarity which is partly explained by the character of their food. From an economic point of view the cuckoos take a high rank among useful birds. Their habit of living more or less concealed among the leaves of trees or shrubs suggests, what observation

proves, that their diet consists for the most part of insects—very largely caterpillars—that are found in such places.

An examination of 155 stomachs of the two species mentioned shows that their food is practically all animal matter—that is, insects. Of this, nearly one-half consists of caterpillars. These are eaten at all times, and stomachs taken in every month of the cuckoos' stay on their northern range show a large percentage of these insects. Some pains were taken to ascertain the exact number of caterpillars contained in the 155 stomachs, but as the process of digestion was far advanced in some cases, the result can only be considered as an approximation. The number actually counted was 2,771, which were all found in 129 stomachs, the other twenty-six being filled with other food. It is probable, and almost certain, that 3,000 would be nearer the exact number. If the contents of all the stomachs examined be regarded as so many daily meals of the same bird, then the result indicates that the bird had eaten 2,771 caterpillars in 155 consecutive days, at the rate of only one meal each day, and some days not eating any. Now 155 days is about the length of time that cuckoos remain on their summer range; moreover, one cuckoo must eat several meals a day, so this number (2,771) probably falls short of the actual number of caterpillars devoured by each cuckoo during the season. From these considerations it appears that cuckoos must eat an enormous number of larvae in the course of a summer. These insects are crude feeders, eating immense quantities of vegetable tissue, and are usually so distended with it that the amount of real nutrition contained in any one of them must be small. In fact, stomachs of birds that have eaten largely of caterpillars always show a quantity of this finely cut vegetable matter derived from the insects' stomachs. As digestion in birds is rapid, it would seem necessary to fill the stomach several times a day with such quickly digested and slightly nutritious food as this, so that the number of caterpillars found in a stomach at any one time probably represents but a small portion of the actual daily consumption. As to the kinds of caterpillars eaten by the cuckoos, it is a singular fact that the hairy and spiny species far outnumber the smooth ones; this may be due either to the greater abundance of the hairy ones or to the birds' preference. This disregard of hairs or spines was well illustrated by one stomach which contained seven larvae of the Io moth (*Automeris io*). These caterpillars are thickly studded along the back and sides with tubercles from which grow many spines, that are not only sharp but poisonous, and sting the hand quite severely when carelessly handled. Several other stomachs contained a less number of these insects.

Among the insects eaten by the cuckoos which are of economic interest to forestry may be mentioned the tent caterpillar (*Malacosoma*), the fall webworm



Louis Agassiz Sartoris.

YELLOW BELLIED SIPSIPY

(*Hyphantria cunea*), and the white-marked tussock moth (*Hemerocampa leucostigma*). The former is eaten to such an extent that it constitutes at least half of the food during the time when it can be obtained. Of the fifty stomachs taken while the tent caterpillars could be found, seventeen contained these insects, and several were entirely filled with them. In one stomach 250 were found. These, of course, were small ones taken in the early stages of their growth, before they had done much damage. The fall webworms are evidently another favorite food of the cuckoo, as they were found in a number of stomachs, and in one 217 heads of these insects were counted. Twenty-eight species of caterpillars were identified in the 155 stomachs, and, as many specimens were unidentifiable, it is probable that there were more species than those noted. Other important insects in the cuckoo's diet are the larvae of sawflies. These so closely resemble caterpillars that they have been called "false caterpillars" and the cuckoos appear to like them as well as they do the real caterpillars. They were found in many stomachs, and one contained over sixty individuals. Larvae of the largest species of sawfly (*Cimbex americana*) were found in several stomachs. The other insects eaten by cuckoos were distributed through several orders, but with no great percentage of any one. The most important, from a forestry point of view, are ants, which were found in many stomachs, but not in large quantities.

The good done by these birds in their destruction of caterpillars can scarcely be overestimated. In the summer of 1898 the writer observed the sugar maple trees in the State of Vermont over a very extensive tract of country nearly defoliated by the forest tent caterpillar (*Malacosoma disstria*). The damage was so extensive as badly to affect the next year's crop of sugar. Had a sufficient number of cuckoos been present to materially reduce the number of caterpillars, much of this defoliation would have been saved, as the trees would stand a moderate reduction of their foliage without detriment. The cuckoos are, unfortunately, rather shy, timid birds. All foresters should know their value, and afford them every protection. The following is a list of all the caterpillars which were positively identified in the stomachs of the 155 cuckoos, but it is almost certain that there were many more so badly mangled as to be unrecognizable.

List of caterpillars identified in stomachs of cuckoos:

Yellow-necked caterpillar	<i>Datana ministra.</i>
Handmaid moth	<i>Datana contracta.</i>
	<i>Nadata gibbosa.</i>
Red-humped caterpillar	<i>Symmerista albifrons.</i>
	<i>Heterocampa manteo.</i>
Army-worm	<i>Heliophila unipuncta.</i>

Zebra caterpillar	<i>Mamestra picta.</i>
American dagger	<i>Apatela americana.</i>
White-marked tussock moth	<i>Hemerocampa leucostigma.</i>
The eight-spotted forester	<i>Alypia octomaculata.</i>
Grapevine epimenis	<i>Psychomorpha epimenis.</i>
Pear wood nymph	<i>Euthisanotia unio.</i>
Fall webworm	<i>Hyphantria cunea.</i>
Yellow bear	<i>Diacrisia virginica.</i>
Southern tobacco-worm	<i>Phlegethontius sexta.</i>
White-lined sphinx	<i>Deilephila lineata.</i>
Imperial moth	<i>Basilona imperialis.</i>
Rosy-striped oak-worm	<i>Anisota virginiensis.</i>
Orange-striped oak-worm	<i>Anisota senatoria.</i>
Green-striped maple-worm	<i>Anisota rubicunda.</i>
Io moth	<i>Automeris io.</i>
Polyphemus silk moth	<i>Telea polyphemus.</i>
Luna moth	<i>Tropæa luna.</i>
Tent caterpillar	<i>Malacosoma americana.</i>
Locust leaf-folder	<i>Epargyreus tityrus.</i>
Mourning cloak	<i>Eu Vanessa antiopa.</i>
Viceroy butterfly	<i>Basilarchia archippus.</i>

THE BALTIMORE ORIOLE (*Icterus galbula*).

Next to the cuckoos the oriole takes rank as a destroyer of caterpillars. Stomach examination shows that thirty-four per cent of the food for the months when the bird is on its summer range is composed of these destructive leaf-eating insects. One stomach contained no less than 100 of these creatures. The oriole is not a lover of the forest, but prefers the more open groves, or the borders of the dense wood. The insects which it eats, however, are the same as those which feed upon the leaves of forest trees, so that by destroying them the bird reduces the sum total of the species, and so benefits the forest as much, if not so directly, as it would if it ate them upon the forest trees. Several other species of orioles are found within the borders of our country, and all of them show the same fondness for caterpillars for food.

THE ROBIN (*Merula migratoria*).

The common robin can scarcely be called a forest bird, though instances have been known where it has nested in the depths of the woodland, and it was observed by the writer in the backwoods of Maine, far from farms or any extensive cleared



SOLITARY VIREO



lands. The diet of the bird, however, merits some consideration in treating of the good work done by birds in destroying forest enemies. The robin eats a large number of injurious insects, but the ones to which attention is particularly called now are the leaf-destroying caterpillars. These constitute over eight per cent of the robin's yearly food, as determined by the examination of 330 of their stomachs. They are a very constant element of the diet, and even the birds taken during the winter months had in some way found quite a number of them, probably from crannies where they were hibernating.

In the summer of 1898, when the forest tent caterpillar overran the maple woods of Vermont, and thereby did much injury to the sugar orchards, thousands of acres were stripped nearly bare of foliage. The insects were of course preyed upon by many birds, but the good work done by one pair of robins deserves to be placed on record. This pair had built their nest upon a maple tree which stood in the corner of a farmer's cowyard, and, like all the other maples in that vicinity, it was covered with caterpillars. The farmer told the writer that every night and morning, as he milked his cows, he watched these robins, which busily fed their young as long as he was there. They did not spend their time going to other trees, but simply took the insects from the outer twigs and leaves, brought them to the nest, and stuffed them into the gaping mouths of the nestlings. This they were always doing at all hours while under observation, until the young were able to leave the nest.

The good work done by robins in distributing seeds will be detailed on another page.

THE VIREOS.

The vireos are a genus of birds that live largely in the forest, and obtain their food from trees. They are rather quiet and unobtrusive, though active, birds, and their plumage is of modest, subdued colors, with no startling or vivid tints. There are thirteen species and ten subspecies within the boundaries of the United States. They are migratory, so that the good work they do in the northern forests is confined to the summer season. As a rule, they do not frequent the deepest recesses of the forests, but choose the more open and parklike portions. Deciduous trees are also preferred to the evergreens. In foraging they somewhat resemble the orioles in the care with which they examine each leaf for possible caterpillars and other insects. They are birds of tireless industry, and seem always to be engaged in their search for insect food.

The vireos are practically wholly beneficial to the interests of man in the matter of their food, which consists almost entirely of insects which are for the most part injurious species. Of these the two most prominent items are bugs (Hemiptera)

and caterpillars. In the case of one species of vireo, the bugs amount to nearly forty-five per cent of the food of the year, and in some months rise to over seventy-five per cent. The families represented are the soldier bugs (Pentatomidae), the buffalo tree-hoppers (Membracidae), the jumping plant-lice (Psyllidae), the spittle insects (Cercopidae), the leaf-hoppers (Jassidae) and scales (Coccidae). All of these insects are to a greater or less extent inhabitants of trees, upon the foliage of which they subsist. Some species of the spittle insects are very harmful to pines, while the scales in some of their numerous species infest nearly every form of tree or shrub.

The next most important element of the vireo's food is made up of caterpillars, with a few of the adult insects (moths). The harm that these creatures do to the foliage of trees has been discussed so often as to require no further comment. The remainder of the food is made up of small beetles, including some weevils, many ants, a few grasshoppers and some other insects.

The following observation illustrates how much good work a pair of these birds may do in the way of insect destruction while rearing a brood of their offspring. A nestful of young, four in number, of the red-eyed vireo was kept under observation from the time that the birds were first hatched until they were able to leave the nest. They were watched for several hours each day in hour periods, which were selected to fall in different parts of the day, so that every hour was represented from early dawn until darkness closed the work. The result was that the young were found to be fed by the parents on an average of somewhat more than twelve times in each hour of daylight, from the time of hatching till they were able to fly. As there were at that time fully fourteen hours of daylight in each day the birds were fed 168 times a day at least; or, as there were four of them, forty-two times each. This means the destruction of 168 insects every day, and probably several times that number.

Besides the various species of birds which have been discussed in the foregoing pages, there are many others that incidentally do a good work in forest preservation by the destruction of its insect enemies. As the tree-destroying beetles migrate from tree to tree, which they sometimes do in swarms, they are preyed upon by the various species of fly-catchers, swallows and other birds that habitually take more or less of their food upon the wing. To illustrate: the destructive engraver beetle *Tomicus pini* has been identified in the stomachs of the following birds: *Contopus virens*, *Hirundo erythrogaster*, *Petrochelidon lunifrons*, *Iridoprocne bicolor*, and *Chordeiles virginianus*.

With the exception of the first, none of these is in any sense a forest bird, and the insect must have been taken on the wing as it was migrating to new fields

of destruction. In the same way many destructive weevils have been found in the stomachs of birds that never could have taken the insect in its feeding and breeding haunts, but while it was migrating for the purpose of finding fresh foliage and new unoccupied feeding grounds. In like manner the whole body of insect-eating birds are at all times preying upon insects that may be more or less harmful to forest trees, but which they find, not in the place where that destruction is wrought, but while in transit from one place to another. Wherever an insect is destroyed, if it be a species that ever feeds upon a forest tree, the forest is benefited by the work, for the species is reduced in numbers, and fewer progeny will be brought forth to prey upon vegetation in general, forests included.

Birds as Distributors of Seeds.

Thus far the vegetable portion of the food of the birds under discussion has not been considered. In the case of many of the foregoing species it is the minor part and of least importance, but still should not be neglected, as some of it plays an important part in relation to the forest. Many trees bear fruits or nuts which constitute an important element of the food of many species of birds, and by them are transported from the forest tree to other places, where they are dropped and often spring up, and if the conditions are favorable grow to be trees. In this way the cedars, the wild cherries, the dogwoods, tupelos, maples, ashes, and all the nut-bearing trees are often propagated. While nature has in many cases provided the seeds of plants with special means for their distribution, many of them are dependent upon the animal kingdom to place them in a situation where they can germinate and grow. In this work various birds play an important part.

When seeds are eaten by birds, one of two things is liable to happen. Either the seeds themselves are broken and ground up by the action of the stomach, aided by the gravel contained therein, or else some digestible coating is taken off and assimilated, and the remainder either passed out through the intestine or regurgitated uninjured. The former takes place in the fringelline birds, the black birds, the gallinaceous birds, and some others that subsist largely upon seeds. In the case where small fruits containing seeds are taken as food, it is the pulp which is sought for, and when the process of digestion has removed this, the seed is usually passed out in a condition to germinate.

It is a time-honored belief that a seed which has passed through the digestive tract of an animal is in a much better condition for germination than before. However this may be, it is certain that when swallowed by a bird the seed has a better chance to be dropped at a distance from the parent plant, where the conditions for

growth are likely to be more favorable. Of all the seeds thus distributed, some are certain to find conditions under which they can thrive, while, if they fell directly to the ground from the branch where they grew, few or none would ever survive.

VEGETABLE FOOD OF THE WOODPECKERS.

The vegetable portion of the food of the downy and hairy woodpeckers consists largely of small fruits of trees or shrubs, the seeds of which pass through the bird or are disgorged uninjured and ready to germinate and grow. The most important seeds found in the stomachs of these species are those of dogwood (*Cornus*), Virginia creeper (*Parthenocissus*), June or service berries (*Amelanchier*), hornbeam (*Ostrya*), sour gum (*Nyssa*), and wild black cherries (*Prunus*). Some of these only rise to the dignity of shrubs, but still have their uses in the forest, while others attain to the size of trees and produce useful timber. Many of the wild berry-bearing shrubs are of no mean importance in the economy of nature. They furnish food for birds, and in many cases for man also. Of these the rubus fruits (blackberries and raspberries) are good examples. The berries are eaten freely by the woodpeckers, which scatter the seeds far and wide, to germinate and produce thick masses of brambles that act as covers to young forest growth, as well as furnish berries.

The two species of three-toed woodpeckers eat practically no vegetable food, or at most none which has any bearing upon the welfare of the forest.

The vegetable food of the flicker is much more extensive in variety and quantity than that of the downy and hairy. It eats many more berries, such as elderberries, huckleberries, spiceberries, mulberries, hackberries, and, in addition to the tree seeds eaten by the foregoing species, it eats juniper berries (*Juniperus virginiana*). This last forms a very favorite winter food for many species of birds, and in the Middle and Southern States this tree is to be seen growing in rows along every fence and by the roadsides, where the seeds have been dropped by the birds when perched upon the fence.

The redheaded woodpecker eats about the same vegetable matter as the preceding, but when there is a crop of beechnuts the bird, instead of migrating, remains north all winter and lives upon them. Dr. C. Hart Merriam has given much testimony upon this point. He states that in northern New York, where it is one of the commonest woodpeckers, it subsists almost exclusively on beechnuts during the fall and winter, even picking the green nuts before they are ripe and while the trees are still covered with leaves. He has shown that these woodpeckers



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invariably remain throughout the winter after good nut yields, but migrate whenever the nut crop fails.*

Mr. O. P. Hay says that in central Indiana, during a good beechnut year, from the time the fruits begin to ripen the redheads were almost constantly on the wing, passing from the beeches to some place of deposit. They hid the nuts in almost every conceivable situation. Many were placed in cavities in partly decayed trees; large handfuls were taken from a single knothole; they were found under a patch of raised bark and single nuts were driven into cracks in the bark. Others were thrust into the cracks of gateposts, and a favorite place of deposit was behind long slivers on fenceposts. In several instances the space formed by a board springing away from a fence was nearly filled with nuts, and afterward pieces of bark and wood were brought and driven over the nuts as if to hide them from poachers.†

Now it seems to be fairly probable, if not absolutely certain, that in all this passing back and forth, carrying beechnuts, some of them would be dropped upon the ground, in places favorable to germination and growth. Observation shows that when a bird drops a nut in this way it does not attempt to pick it up, but simply goes for another. Nor is it improbable that many of these nuts are placed at first in places where they can sprout and grow if left undisturbed, as must often be the case. There is no testimony to show that the woodpeckers themselves ever hide the nuts in the ground, as some other birds are known to do, but there seems to be no reason to doubt that they might sometimes do so.

The yellow-bellied sapsucker eats rather fewer articles of vegetable diet than the downy and hairy, but they are practically of the same kind.

The same may be said of the pileated woodpecker. This bird shows a fondness for fruits, which constitute a larger percentage of its vegetable food than of any other woodpecker except perhaps the flicker. The seeds of the sour gum, wild grapes, and persimmons appear in many stomachs, and indicate that these fruits are a favorite food.

There is one seed that is found in the stomachs of nearly all the woodpeckers and many other birds, especially in winter, whose presence there, however, is to be regretted. This is the seed of the poison ivy (*Rhus radicans*), which is a favorite winter food for many birds. The seed is surrounded by a coating of white wax-like substance which appears to be quite nutritious, so that although it is but a small part of the seed it evidently affords sufficient nutriment to supply the bird's wants. It is not unusual to find a stomach completely filled with these seeds from

* Birds of Connecticut, 1877, p. 66; Bull. Nuttall Ornith. Club, Vol. III, 1878, p. 124; Mammals of the Adirondacks, 1884, p. 226.

†Auk, Vol. IV, 1887, pp. 194, 195.

which the wax has all been removed by the process of digestion. This large quantity of seeds then passes through the intestine, or in some cases, notably the crow, regurgitated and scattered broadcast, ready to grow and produce a great number of these disagreeable and, to some people, dangerous plants. This vine is in itself ornamental, especially in autumn, and were it not for its poisonous qualities would be a desirable plant for covering unsightly objects like stumps and dilapidated walls and stone piles. As it is, however, its presence is always to be deplored, and while it subserves a useful purpose in furnishing food for many birds in a season of scarcity, it is unfortunate that the seeds are not devitalized in the process of digestion. There is at least one bird, the chickadee, which, while it subsists to some extent upon this seed, does not assist in its dissemination. This bird is too small to swallow so large a seed, so it merely pecks the wax from the outside and leaves the seed upon the parent vine. There is another vine which closely resembles the poison ivy, but is harmless. This is the Virginia creeper or woodbine (*Parthenocissus quinquefolia*), and as its seeds are borne in an attractive berry they are eaten by birds nearly as much as those of the ivy, and are scattered in the same way. For this we are duly thankful, as the plant is at all times ornamental, and its beauty in the fall is proverbial. The resemblance between the two is unfortunately very close, and many distressing accidents have happened when inexperienced persons have gone in quest of autumn leaves and have mistaken the ivy for the woodbine.

THE ROBIN.

As an eater of fruit and a distributor of seeds the robin has few, if any, rivals, except possibly the cedarbird. In the examination of 380 stomachs there were identified forty-two different species of wild fruits, of which the seeds would either pass through the intestine unharmed or would be regurgitated, but in either case would in all probability fall where they could sprout and grow. Some of these, like the wild cherry, the sour gum and junipers, are genuine trees, while others, like the dogwoods, the bird cherries and the amelanchiers, are of smaller growth, and still others are only shrubs. As the robin is not a frequenter of the forest depths, the seeds would be dropped, as a general rule, away from overshadowing trees, and so have the best possible chance for growth, and in this way the forest is extended.

THE CEDARBIRD (*Ampelis cedrorum*).

This bird, like the robin, subsists largely upon fruits, the seeds of which it distributes far and wide. The wild cherry, the sour gum and the juniper are three species whose fruit is much eaten by the cedarbird, and the seeds scattered in a thousand places where they have a chance for germination and growth.



Louis Agassiz Gurney

BLUE JAY

THE JAYS.

There are within the limits of the United States ten species, with several subspecies, of jays, all of which inhabit the forest, or at least avoid the habitations and improvements of man. In the east there are two species, the blue jay (*Cyanocitta cristata*) and the Canada jay (*Perisoreus canadensis*). On the Pacific coast several species of jays are found, but two are conspicuous, as they inhabit the more thickly settled portion of that region. These are the California jay (*Aphelocoma californica*) and Stellar's jay (*Cyanocitta stelleri*). In their general habits they strongly resemble the blue jay of the east, and their food habits are much the same, though the western species feed much more freely on fruit than their eastern relative. This perhaps is owing to greater opportunities, and the taste may be an acquired one. Like the eastern species, however, mast is a prominent ingredient of their food, and it is this which renders the group of interest to foresters.

THE BLUE JAY.

Of all the birds of the forest, there are few that are more conspicuous than the blue jay of the east. Its plumage is of the most brilliant hues, and its voice is loud and piercing. Besides, it is an active bird, and always seems to have a good deal of business on hand, but still has plenty of time to inquire into yours if you happen to trespass upon what it considers its own especial domain. As the bird is a resident in most parts of its range, it is seen most often and to the best advantage in fall and winter. At such times the brilliant hue of its plumage is finely contrasted with the crimson leaves, or with the snows of winter.

It is as a nut eater that the jay becomes of the most interest in its relation to the forest; still its diet does contain a fair percentage of harmful insects. Among those eaten were a number of beetles belonging to the genera *Cotalpa*, *Pelidnota* and *Lachnosterna*, all of which are injurious to trees, while some *Chrysomelids* were taken, which feed upon foliage. Besides these, several weevils belonging to the genus *Balaninus* were eaten. This insect infests acorns, chestnuts, etc., and was probably taken by the jay while collecting mast, which is its favorite food. Caterpillars are also eaten to some extent in the last of summer and early fall. In the winter months the jay eats the eggs of injurious moths, notably those of the tent caterpillars (*Malacosoma*). Mr. E. H. Forbush records that it fed freely upon the larvae of the gypsy moth, perhaps the most destructive enemy to the forest ever known in America.

The largest item of food in the yearly diet of the jay is mast—that is, acorns, chestnuts, chinquapins, beechnuts, etc. The jay not only eats these but stores

them up for winter use in various cracks and crannies, or frequently simply places them in a fork of a tree branch, and it is in this work that it does its greatest good for forest propagation. The writer has often found stray acorns, chestnuts, etc., in open fields far from the parent tree, where they had probably been accidentally dropped by jays when being carried to some place of concealment. At such times these birds have a great deal of business on hand, and do a great deal of flying about and screaming; and whether they can scream and hold a nut in the beak at the same time is doubtful, so it is probable that a goodly proportion of the nuts that are intended for storing are dropped in transit. The California jay has the habit of storing acorns in the ground, and Dr. Merriam informs me that the Indians of that region call the jay the oak planter, and say that every oak that grows is from an acorn planted by one of these birds. Whether the eastern species ever intentionally places acorns in the ground I am unable to say, but it is certain that it puts many there by accident, and often those that are stored are in positions where they may germinate and grow, such as cracks in stumps or partially decayed logs. Moreover, many nuts are either by intention or through carelessness left on the tops of fenceposts, or in forks of trees, from which the wind will easily dislodge them.

The Canada jay is the most northerly of any of the jays, extending its range well up into the Arctic regions. It is a denizen of the coniferous forests, and it is not known whether it ever feeds upon the seeds of these trees. If it does it probably aids in their distribution.

THE COMMON CROW (*Corvus brachyrhynchos*).

As a distributor of forest seeds the crow deserves at least a passing notice. During the winter season the crow feeds largely upon the more or less dried up fruits of the previous summer, with many seeds of the poison ivy. The indigestible portion of this food—that is, the seeds or stones—are disgorged after the available nutrient part has been removed by action of the stomach. The seeds so disgorged are in no way injured, but are in excellent condition to sprout and grow. In many parts of the country, crows have a habit of gathering in one place to roost at night, though during the day they distribute themselves over a large area of country to forage. One of their roosts which was inspected by the writer was estimated to be occupied by at least 250,000 crows at night, and extended over several acres of forest. All through this area every square inch of ground was covered by the disgorged pellets made up of seeds and gravel which were rejected by the birds during the night. On this ground many bushels of seeds



AMERICAN RED CROSSBILL
UPPER FIGURES MALES, LOWER FIGURE FEMALE

of wild grapes, sour gum, juniper, dogwood, viburnum and poison ivy could have been gathered. As the crow is an inhabitant of the forest or its immediate vicinity, it feeds largely upon the fruits of the forest, and thus distributes the seeds by which it is replenished.

THE PINE GROSBEAK (*Pinicola enucleator*).

The pine grosbeak is an inhabitant of the northern portion of North America, and a winter visitant to the more northerly parts of the United States, sometimes coming as far south as Pennsylvania. It is, however, rather erratic in its movements, and is often absent from some localities for a series of years, after which it may again become abundant. During its winter stay in the United States it is wonderfully tame and confiding, and can usually be approached to within a few feet, and sometimes can be taken with the hand.

The food of the grosbeak is mostly obtained upon trees, and consists of seeds and small fruits during the months when the bird is not breeding. Accurate data are lacking as to the bird's diet while engaged in rearing its young, but it is probable that at that time it consists principally of insects or other animal matter. The seeds eaten consist mostly of those of trees such as the ash and the conifers. It takes the seeds from the cone by means of its stout beak, and while most of them are eaten and so destroyed, many fall to the ground where they can germinate. The fruit which these birds eat is mostly of such species as grow upon trees or the larger shrubs, like the juniper, the sour gum and the viburnums. The seeds of these of course pass through the intestinal tract uninjured and are distributed where they have a chance to sprout and grow. Besides seed and fruit, the bird subsists to some extent upon buds, and is accused of doing damage to trees in this way, but it is doubtful if the injury is serious.

THE CROSSBILLS (*Loxia curvirostra minor* and *C. leucoptera*).

The crossbills, like the pine grosbeak, are residents of the north, and make irregular excursions into the country lying farther south. While in a general way these southern migrations occur at the beginning of cold weather, and the return northward in the spring, yet in the case of the red species (*L. c. minor*) the birds often linger in the south till spring is far advanced. Another of their peculiarities is that they frequently breed in midwinter, even in a climate as cold as that of central New England, and this may account for the fact that they are in no hurry to get back to the north in the spring as their procreative duties may have been already performed.

The food of the crossbills resembles that of the grosbeak, as they are strictly forest inhabitants, and obtain most of their food from trees. A small number of stomachs of these birds has been examined, and the uniformity of their contents leads to the belief that they give a fair idea of the general food. Seeds are the favorite article of diet for the greater portion of the year, yet during the summer time some insects are eaten. A number of stomachs of the red crossbill taken in the summer months yielded specimens of only two orders of insects—viz, caterpillars and plant-lice. These last appear to be a very favorite food, for several stomachs were nearly filled with them, and one contained nothing else. It scarcely needs to be pointed out that in eating these insects the crossbills are doing a good work for the forest.

It is, however, in their character as seed-eaters that the crossbills are best known. Their preference for coniferous forests as a place of residence and their fondness for the seeds from the cones has long been a matter of observation. The peculiar structure of their bills enables them to extract and hull the seeds of the pines and other conifers with a deftness which can be equaled by no other bird. As a consequence, the seeds of the cone-bearing trees form the largest item of their food. Of course the seeds that are thus eaten do not help to perpetuate the forest, but many seeds are scattered broadcast, and it is probable that by this means more of them are placed in a location suitable for germination than would happen if the cones were left upon the trees unopened until they fell of their own weight.

The Birds of Prey.

While the smaller mammals, such as mice, voles, wood-rats and rabbits do not habitually do any remarkable damage to the grown forest, they are very destructive to young trees, and in the forest nurseries often cause great losses by girdling young stock. These creatures have long been a source of annoyance and expense in young orchards and nurseries of fruit trees, and where efforts are being made to raise forest trees for the purpose of artificially restocking forest areas it is found necessary to take measures to guard against these pests, or much of the labor and expense will be wasted.

It is in such emergencies as these that the beneficial work of the hawks and owls is appreciated. The food of these birds has been thoroughly studied and discussed by Dr. A. K. Fisher, and his publication upon the subject is a model of painstaking labor.*

*The Hawks and Owls of the United States, in Their Relation to Agriculture, Bulletin No. 3, Div. Ornithology and Mammals, U. S. Dept. Agric. By A. K. Fisher, M. D.

Dr. Fisher has shown that the principal food of these birds, with a few exceptions, consists of small noxious mammals, such as rats, mice, rabbits, etc., and it is probable that they are the most potent factor in preventing the undue increase of these pests. The common cotton-tail rabbit, as well as others of his ilk, is a constant menace to young nursery stock of either fruit or forest trees, and as these creatures are nocturnal in their habits, they feed at a time when it is practically impossible to protect the trees from their depredations. But nature has kindly arranged that two of our largest species of nocturnal birds—that is, the great horned owl and the barred owl—should prey upon the rabbits, and so keep their numbers within bounds. In most cases they would do this work effectually if unmolested, but it seems impossible for a man with a gun to abstain from killing an owl if a chance is presented, and then to justify himself will declare that owls kill pigeons, poultry and game birds.

That the majority of the birds of prey feed to an injurious extent upon birds or poultry is a contention which has been thoroughly refuted by Dr. Fisher. That they do occasionally attack poultry, and sometimes, when hard pressed, kill small birds or game no one will have the hardihood to deny, but, as Dr. Fisher has demonstrated, these cases constitute the exception and not the rule. The normal food of the various species of hawks and owls, with two or three exceptions, consists of the small mammals, mostly of the order of Rodentia, all of which are more or less harmful to the interests of agriculture, and some are pests. The smaller species of owls, preying as they do in the night, come in contact with mice and voles, whose habits are more or less nocturnal, and find the principal source of their food supply in these noxious creatures. During the winter season, particularly if the snow be deep, these mice and other rodents subsist largely upon the bark of young trees, which they girdle beneath the surface of the snow, and in this way ruin thousands. During daylight many of these creatures are captured by the various species of hawks, so that the good work of destroying them is carried on throughout the whole twenty-four hours.

Perhaps the most striking instance of the good work accomplished by birds of prey is the case of a pair of barn owls that have for a number of years occupied one of the towers of one of the public buildings in Washington. Dr. Fisher has at various times visited this eyrie and gathered the disgorged pellets containing the undigestible portion of their prey, which it is well known the birds regurgitate. In all there were collected 675 of these pellets, and by a careful analysis they were found to contain the bones of 1,787 small mammals, thirty-two birds and two frogs, or 1,821 individual animals in all. These, it must be borne in mind, were collected in the parks and the immediate vicinity of a large city, which one

would scarcely consider as the best kind of a hunting ground. This species of owl is an abundant resident on the Pacific coast, and must have a very decided effect upon the small mammalian fauna of that region.

Damage Done to Trees by Birds by Destroying Buds.

In treating of the pine grosbeak, reference was made to the fact that a portion of its food consists of buds of trees. The pine grosbeak, the crossbills, the purple finch (*Carpodacus purpureus*) and other species of the finches, and the ruffed grouse and perhaps some others, have all been accused of doing harm to trees by eating the buds, both of blossoms and leaves. As far as the writer has been able to observe, very little such harm is done, even when the disbudding has been quite extensive. As a general rule, buds upon trees are superabundant. Moreover, nature has kindly arranged that when one set of buds are taken from a tree a new supply are at once developed from around the bases of the old set, or often at a distance from these places, and the tree appears to suffer no appreciable harm. In one case which came under the writer's observation, a portion of the mowing land of an abandoned farm was by nature seeded to poplars (*Populus tremuloides*), which came up very thickly over a considerable area. When these trees were a few feet in height they became the feeding ground for ruffed grouse from the adjacent woods, and these birds might be seen feeding there any evening during the winter months.

As the area of forest was quite extensive, there were many grouse that soon made the poplar patch their regular foraging ground; but, in spite of this, within ten years the trees had grown to between thirty and forty feet in height, and were as thrifty as could be desired.

In another instance an apple orchard was bounded on two sides by woodland and the grouse "budded" extensively upon the trees that were nearest to the forest. These birds are supposed to have a special fondness for the blossom buds of apple trees, and often venture to quite a distance from their forest retreats in order to gratify this taste, so it is to be inferred that in the instance where the trees were so easily accessible they did their best, or, from a horticultural point of view, their worst. In any case a careful inspection year after year of the trees nearest the woods did not show any inferiority in fruit bearing or in any other respect as compared with those at a distance. Most trees, either of the orchard or forest, produce several times as many blossoms as they are able to mature, so that the taking away of a portion of them, if not carried too far, is a positive benefit.

Fishes and Fishing in the Adirondacks

From the Sportsman's Point of View.

BY A. JUDD NORTHRUP.

IT might as well be confessed at the outset that the Forest, Fish and Game Commission are not to be held responsible for any faulty views or erroneous opinions expressed in this article. They have kindly left the writer free to say what he will, and he alone is responsible. Some things he may say will doubtless be "random casts," and often wide of the mark, but that is not an uncommon experience of fishermen.

Prior to forty years ago, or thereabouts, very few of the people of this State had much knowledge or any due appreciation of the special nature and value of the Adirondacks. In "the good old times" before Murray wrote his facts and fables of that enchanting region, the sportsmen and the dwellers along the fringes of the forest had the monopoly of the fish and game, and the lovers of nature among them the enjoyment of the marvelous forests, lakes, rivers and mountains. Year after year, "accoutered as they were," in their old woolen clothing, with pack baskets, "supplies," fishing tackle and guns, they rather shyly (for they were frowned on in those days) slipped off to the "North Woods" for their glorious sport with rod and gun and camp. In May, and again in July, they reached the edge of the forest as best they could, with no railroads to make approach easy, and then came the rough trails, the unmarked ways to the favorite resorts, the streams down which the waters tumbled over rocks and precipices, with here and there a welcome "still-water," until at last the chosen spot on stream or lake, and possibly a rude camp of logs or bark built in other days of delight, was reached. And then heaven smiled on them, and the leaf-clad earth gladdened them, and the forest swayed its great tree tops in joyous welcome! Fish? Worlds of them! Trout, speckled and "salmon," mostly. These had little fear of man; they were not educated to fear. They took the deceitful fly, worms, fish tails or fin, pork rind, the red rag—anything.

The deer, too, were there, and venison steak was in season all the year round. There were no game laws to speak of—at least none that the sportsman remembered. And the sportsman had the primeval hunger. He lived like a lord, a lord that had fresh air all day, on the streams or lakes, and through the night in his open camp; and his appetite was like that of a modern locomotive going up grade. Trout, venison, flapjacks and maple sugar, and coffee went into his cavernous stomach, and he got up steam for long tramps, and slept without a bad dream.

The sportsman had all this world to himself (save the invasions by the pot fisherman of the semicivilized border settlers in other days). And he kept it to himself and a few chosen friends, for the public counted him a tramp, a vagrant, rather than a sportsman. Those were the barbarous days before vacations came into fashion. So, the good steady people of the State knew very little of the Adirondacks, their beauty and sublimity, their healthfulness and health giving, the material riches and value of the forest growths, the mines of ore, the reservoirs of water in the leaf-mold soil and in the lakes—water that fed the lazy rivers of the outer world in summer, and turned the wheels of many mills outside. None of these goodly, steady people cared much for the rude, rough wilderness up north, where wheat and corn and meadow were unknown. Legislators had no incentive to make stringent laws for the protection of a region deemed worthless nor executive officers to execute the few laws for the unappreciated wealth of forest and waters.

A few simple wise men, it is true—even the guileless Emerson at one time and his company of like-minded philosophers—loved and sought nature here, and sang the glories of the forest. But their voice sounded afar off to the common ear.

Then came Murray and Headley with blare of trumpets and the speech of the people, and dear old W. C. Prime, who put "I Go a-Fishing" into a book with artistic and scholastic taste; and they severally told the story of their happenings and happiness in the forest.

The secret was out! The Adirondacks were discovered. Then came the rush of the multitudes; later, the rude highways, and lastly the railroads and the screech and scream of the steam whistle on rails of iron, on streams and lakes; and the great hotels, with gas, electricity, dancing, card parties and all the paraphernalia of a new Saratoga. Vanished then the happiest days of the primitive sportsman, with his rude camp and rough clothing and his as yet guileless guide. The command of the new events and new multitudes was to "move on!" and he hied himself to valleys among mountain fastnesses and the little lakes hidden there; or, he changed, not his skies, but his nature, put on good clothes,



“GOING IN”—OLD STYLE.



FROM PHOTOGRAPH BY HON. IRVING G. VANN.

INSCRIPTION ON ROCK IN CRANBERRY LAKE:

“IN MEMORY OF REUBEN WOOD, A GENIAL GENTLEMAN AND GOOD FISHERMAN, WHO WAS FOND OF THESE
/ SOLITUDES.”

knickerbockers, a linen collar, lived in a caravansary, made "trips," dined in a dress suit and attended "hops," and became another creature altogether. For the old fishing resorts were fast being depleted; the rude camps were supplanted by cottages and hotels; sport became work; fish baskets grew smaller, and too large at that, for they seldom ran over.

Yet, the genuine sportsman—not the man who fishes to fill a tub and salts down trout for his winter's food—think of that!—did not regret that women and children and invalids came to his old haunts and drank in the beauty and joy and health that so long had been his own. The "gentle sportsman" sighed for what had departed, but breathed a thanksgiving that these others might now share these blessings—even a goodly portion of his own.

Still, he of the generous soul clung to his old ideals, the open camp, the hidden lakes and streams, the immediate contact with nature, made his own fight with whatever of hardships of tramp or weather, and gloried in the freedom from the outer world's work and worry—and by and by, came out strong from the old, old toil and fun!

In the old times we built our rude camps substantially in this wise: First, we laid logs two or three feet high on three sides (sometimes we omitted the logs), leaving an open front; then put up crotches to sustain a pole in front seven or eight feet above ground, on which poles were laid sloping to the logs (or ground) in rear, as a framework for the roof. On these were laid broad sheets of bark peeled from the bodies of spruce trees; on the sides were upright sheets of bark tucked snugly under the roof; the whole structure making an open camp extending in length according to the requirements of the number to be housed. A heap of stones, if obtainable, was placed in front a few feet distant for the fire of logs on which the cooking was done and a fire kept up to warm the camp at night and afford the evening light for the talks, fish stories and the soothing pipe. The bed in camp was composed of the finer twigs of balsam boughs, or hemlock if balsam could not be procured. Sometimes rude bedsteads were constructed on which the boughs were laid, but oftener, especially if the camp was to be used only for a short time, the boughs, well "shingled" and the finest on the top, were laid, six inches or more thick, upon the ground. A single small log laid on the ground at the front of the camp served as a seat before the fire and to keep things snug under cover. Various additions to comfort, by way of stools, rude camp chairs, etc., often were constructed, lines were stretched and nails driven on which to hang clothing and blankets.

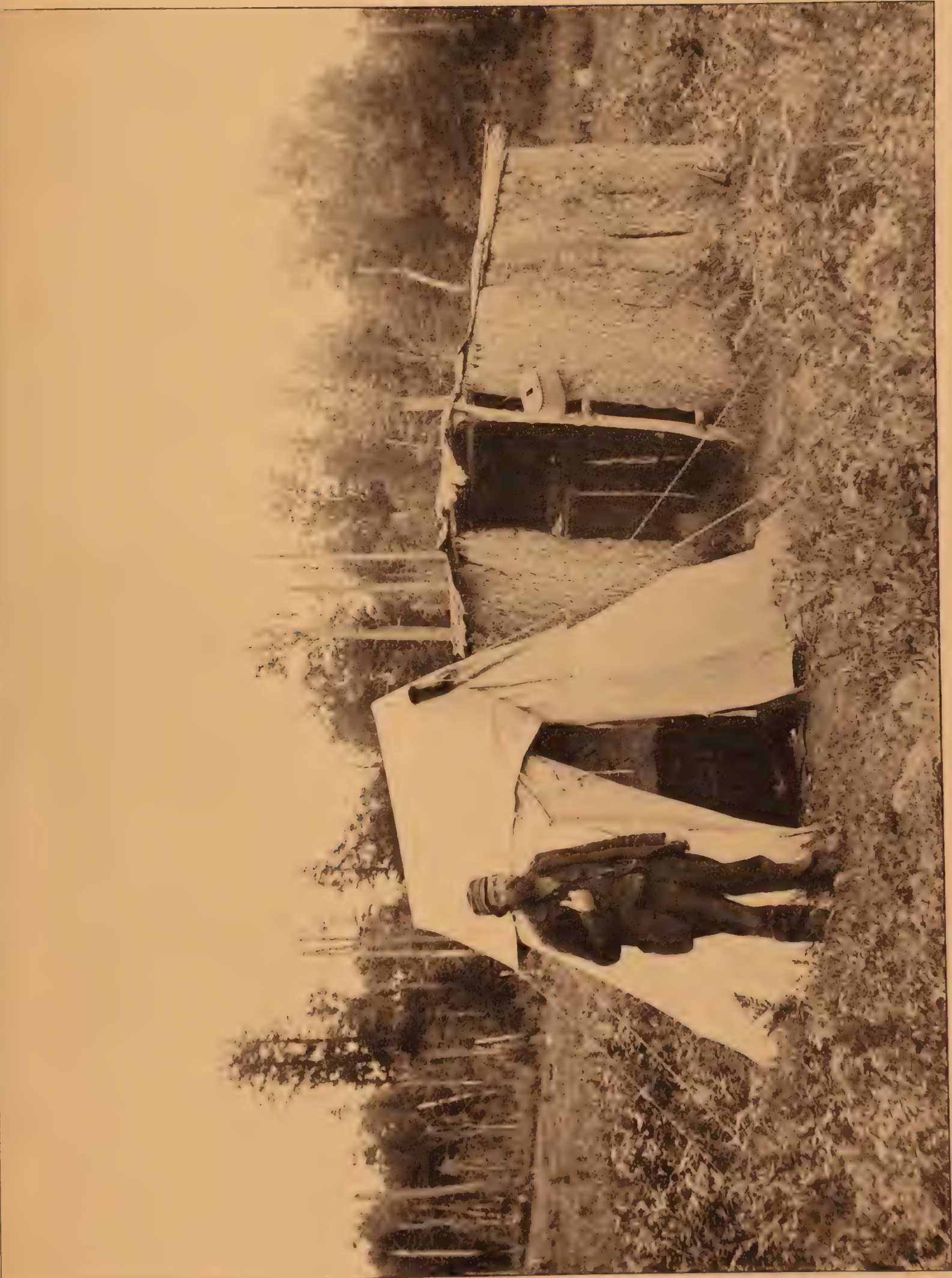
The dining-room (a luxury sometimes indulged in), built separately, consisted simply of a nearly flat bark roof supported by posts set in the ground, and the

“room” furnished with a bark table, and a long seat on two sides consisting of strong poles. Then the “camp” was deemed to be complete and comfortable if not elegant. Sometimes, if the same party visited a camp ground year after year, a rude structure of logs was made—always with bark for a roof—and often even indulging in the luxury of a door.

The peeling of spruce trees for the bark was a fearfully wasteful but somewhat indispensable and excusable matter at a period when it was impossible to procure other material than bark for roof and siding for the forest home. That necessity has passed since the means of transportation have so vastly improved, and serviceable and comparatively light and cheap paper roofing is made. Besides, light waterproofed tents for camping are easily transported, quickly set up, and serve the camper's needs fairly well. The old-time camper, however, still laments the passing of his open camp, his bed of boughs, and the cheerful fire in front. Even the smoke that brought tears to his eyes and choked him in the middle of his best fish story had a fascination that the tent can never create.

It requires a bit of genius to know where to build the camp or pitch the tent. It must not be under or near a tree liable to fall or blow down. Of course it must be reasonably near the fishing ground, by stream or lake. It ought, too, to be near a good spring of drinking water, or a very clear and cold stream. One should, and will be inclined to, drink an abundance of water—water with no bacteria to bother him when he goes home. By the way, the less bottles one carries into the woods the better. Better even to have a few bacteria now and then than an abused stomach and befuddled brain. One doesn't need to be much of a sportsman to learn after a little that punkies, black flies and mosquitoes are the black clouds of which good fishing is the silver lining. The less cloud, however, the better. The camp, if possible, should face toward the prevailing breeze. That drives away some thousands of the pests. Sunlight, to make the camp dry, is desirable. A breezy, sunlit camp, near a good spring of water, facing a pleasant view, near good fishing grounds, is a joy forever—in memory as well as realization.

The game fish of the Adirondacks, until recently, were all of the trout family. The black bass is a new comer, and he came because he had to. He was drafted to fill the depleted ranks of the trout. Perhaps he continues the process of thinning out the trout—which the lumberman began and the multitude continued. It probably depends largely on conditions. If he can otherwise get all the food he wants, quite likely he will not seriously disturb the spawning beds of the trout or chase to their death the troutlings. But the black bass is a glorious fighter, game to the last, and the sportsman will not quarrel with his



AN OLD-TIME SANITARIUM.
STILLWATER ON THE BEAVER RIVER.

coming in waters that practically have ceased to be inhabited by trout. A fine feature in Adirondack fishing certainly has been added.

The great enemy of the trout is the wicked pickerel. *Anathema Maranatha!* say all sportsmen, upon the heads of the villains who for revenge or from pure, unadulterated accursedness have introduced this fish demon into the happy home of the trout family!

How to catch trout, is the question the beginner asks, and the answers will depend on various facts—seasons, waters, weather, times of day, and amount and quality of food the fish are having, and the mood of the fish themselves. Then, again, the ardent fly fisherman will decry bait fishing; the bait fisherman will boast of his catches and tell you that his basket contains the larger and more numerous fish. Again, the fly caster will descant upon flies learnedly and show you such a variety that you will wonder how he learned so much of the tastes and preferences of the trout family.

However, some facts about the matter are plain. In May, after the ice goes out of the rivers and lakes, the trout are hungry, and roam about in search of food to break their long fast. Bait fishing is then in its best estate, and fly fishing only mildly satisfactory. Earth worms and grubs seem to be most attractive, but other kinds of bait will serve. Trolling in the larger lakes along the shores and around rocky islands, with bright spoons to draw attention to the angle worms trailing from the hook, is successfully practiced. Very early the fish begin to ascend the rapids, and there fly fishing is likely to be good.

Spring is the season when parties from the "border" come into the Adirondacks and fish for the tub. They camp by a lake, and clean it out. It is said that last year one such party, in two weeks, caught, in one of the smaller lakes not far from Cranberry Lake, four hundred pounds, which they salted down like so much pork! It is not surprising that the summer fisherman found that lake "poor fishing." In Cranberry Lake, in the spring of 1904, a whole fishing fleet trolled along the rocky points at the south end of the lake and around Buck Island, day after day, taking a vast quantity of large trout. The following summer, sportsmen wondered why that celebrated fishing resort had ceased to afford the royal sport of former years and why the spring holes yielded so few trout. The story of the spring fishing gave the answer.

Late in June, and during July and August, the trout seek the cool water, and crowd into the little coves where cold streams enter lake or river, or ascend streams toward their fountain head. Then artificial flies are the most attractive lure and give the sportsman his greatest pleasure. Bait, however, takes the big sly fish that hug the bottom, although at certain hours, notably at evening, they

rise to the fly; and if the fisherman's chief desire is to fill his basket, without regard to the pleasure, he may perhaps successfully with bait compete with the fly fishing sportsman. This he can do, however, only where there is deep water. There is no comparison in the pleasure of the two methods, even when baskets are even.

Lake trout may be taken, in the spring, by trolling along the shallow water near shore or around rocky ledges, and in the summer with bait or by deep trolling. Such fishing, however, is mainly a matter of providing a breakfast, and can hardly be called sport.

On no point do sportsmen differ so much, perhaps, as upon choice of, or preference for, certain flies. The amateur will show you a gorgeous hued assortment that would bewilder the wisest fish and cause inextinguishable laughter in his family. The old-timer—who has had that craze and recovered from it—meanwhile will have a half dozen tried and true favorites, each with a history of victories fairly won, and now on the retired list, while recruits of the same sort are on duty. If, however, one were on a tramp through the forest, and his life depended on now and then capturing a trout, and he could have but one fly, it should be the humble, modest brown hackle. It is perhaps suited to more times, seasons, waters and fish appetites than any other—and yet one may still have his half-dozen favorites. For use on the dark Adirondack waters trout flies may be larger than those used on clearer waters.

As for rods, the good old ash and lance wood variety of former days has disappeared, and the light, strong, supple split bamboo has taken its place. A good bamboo rod is the acme of excellence. The steel rod has its admirers also. The automatic reels are a delight to those who have learned how to use them and when and when not to “push the button.” The finer the tackle the more the pleasure with a skillful hand at the butt. The success, however, measured by the basket is not always commensurate. The rough and tumble of much of Adirondack fishing suggests the use of a fairly substantial fishing outfit.

By reason of destructive agencies, some of which have been mentioned, only on the private preserves, in streams and lakes somewhat inaccessible to the less enterprising sportsman, and here and there a lake unusually fitted for the growth of trout, are they found in anything like satisfactory numbers. Do what they may, the State hatcheries cannot do much to meet or arrest the decrease while these abuses continue, and the sportsman predicts in sadness that if they are not checked the next generation very likely will know nothing of Adirondack trout fishing except from tradition and books.



OSWEGATCHIE FALLS, NEAR HUMES.

There are some very evident causes of this condition—causes which the State could have prevented or arrested if it had begun the work of preserving the forest, fish and game in time. Apparently, it was only when it began to see that commercial interests were involved, and water for navigation and water power was diminishing from a denuding of the forest, that the State awoke to the situation, then too late to undo the mischief, and undertook to save something from the wreck. The damage cannot be repaired within a decade, a quarter or half century. But a beginning has been made, and with a serious effort the Adirondacks some time—not while the older sportsmen are on earth to enjoy it—the forest may come back to something like its old glory, and the native home of the trout fitted for their return.

The greatest injury to the forest—and incidentally to the game fishing—has been caused by the reckless lumbering of privately owned lands, and some of the worst results of this profligate use of the forest growths have come about by the destructive fires that frequently follow the cutting and removal of pretty much all the trees, large and small. There is no desolation more gloomy and forbidding than a forest section stripped of nearly all its trees and then burned over, the very soil destroyed, and the bare rocks and ghostly scattered tree trunks, dead and blackened, telling of the raging, devouring forest fire. Bird and beast shun the region as if it were accursed. The streams, once cool and full, shrink and shrivel; the shady nooks and covering under which the trout used to sport and multiply are gone, and the trout themselves have sought other homes—if the devastation has left access to any such.

Then, too, the traffic by steamers plying on the lakes and navigable streams, however desirable or necessary, disturbs the shy fish in their natural haunts and sometimes destroys or seriously disturbs their hatching beds.

No doubt it is wise to introduce bass in certain waters which from one cause or another the trout have practically ceased to inhabit and to which, for various reasons, they cannot be restored. The bass is a game fish with which the expert angler will be glad to test his skill and fill his basket and to meet and enjoy at his table—if he cannot follow the trout. Nevertheless, he is a menace to the trout, and, as has already been suggested, if not otherwise well fed will complete the work of extermination of the trout still struggling to maintain the reputation and traditions of the old fishing waters. There is no excuse, however, for the pickerel in the Adirondacks. His introduction there was fiendish and his work among the gentle trout family is as devilish. Both these fish multiply rapidly and work out their instincts vigorously. Where they both abound, the old type of Adirondack sportsmen will certainly be seen no more.

Of course, the immense increase in the number of fishermen—legitimate sportsmen in large part, perhaps—accounts for a part of the decrease of the trout. For a long time, pot fishermen from the “border” have entered the Adirondacks in the early spring and “fished to death” the lakes and streams they infest.

Fishing the small streams where the young trout betake themselves—their nurseries—is one of the most destructive agencies for depleting the larger streams and lakes, to which these trout if allowed to live would return grown to a size enabling them to maintain themselves with the enemies of their babyhood. The slaughter of these innocents out-Herods Herod. If a man claiming to be a sportsman is guilty of this murderous business, he is somewhat paid for it in the loss of legitimate sport in the larger waters. He ought to be prohibited from the act by law and punished vigorously for doing it. The writer remembers still, with a share of his old rage yet in his blood, seeing the catch in the northern wilderness of two fish murderers from his own city some years ago, who returned at night after one day’s fishing a small stream, showing with great glee their catch of about four hundred baby trout! And at that time and place there was no law to prevent their cruel and wasteful work. Between the pot fishers who in spring “clean out” the lakes and these July baby killers the trout have a hard time. State and Preserve hatcheries wage a doubtful warfare against such enemies, but with the help of legal restraints and rigid enforcement of law they may yet win the battle.

The first remedy for this state of affairs is to bring the wild lands of the Adirondacks into the State Park as rapidly as possible, and then guard it from abuses such as have been described. It will take money to do this, of course, but it is money well spent. This wilderness ought to belong to the people of the State. It is unique, like Niagara Falls; of value as the sanitarium of the people; the great vacation park, and “play ground” of grown up men and women; and now that the sportsman is no longer in popular estimate “an idle fellow,” and his name has become legion, it would seem as if he might be considered just a little in this matter.

First and foremost, the denuding of the forest should be stopped where it is; or, if valuable lumber is to be removed, it should be by selection and care and under stringent regulations, by which a sufficient proportion and quality of trees to really preserve the forest should be left standing, and by which—and this is all important—the material for forest fires shall be removed or carefully destroyed. Where the State acquires the whole title to a tract, this, by proper means, can readily be accomplished. Where the State acquires title subject to the right of



“CHRIS ’ WAGNER.

the original owner to cut trees, as it is sometimes compelled to do in order to acquire the lands at all, the enforcement of the protective regulations should be followed up with the greatest watchfulness and effectiveness. Of course, this is exceedingly difficult in such a secluded and wide area.

Laws should be enacted controlling the methods of lumbering on forest lands owned by private individuals or companies; on the same general principle that in cities the erection of buildings may be controlled in the way of preventing fires. It cannot really be difficult to frame legislation to compel individual owners to so use their own property as not to imperil the property of their neighbors, whether their neighbors be the State or individuals.

Again, there ought to be a permanent State law against fishing the small streams in the Adirondacks. It is not easy to say in a statute what a "small stream" is, and perhaps some provision could be framed leaving that as a designation to be applied by the Forest, Fish and Game Commission to certain streams and the provisions modified from time to time. At all events, fishing in fish nurseries should be absolutely prohibited if any protective laws whatever are worth having.

Limiting the number or quantity of trout one person in one day may take would certainly be wise. The Forest Preserve belonging to all the people, and its fishing privileges and fish being theirs in common, and since there is not now "enough to go around," legal restraint of those who selfishly would take more than their share is right in principle and has become necessary. The golden rule needs to be put on the statute books, with penalties to back it up to make it effective—the millenium not yet having arrived.

With all these provisions accomplished and in working order, the State and club hatcheries would play a still more effective and important part in their attempt to restore the sportsman's paradise lost. With the clubs owning and protecting their own preserves, they accomplish their object. The forest—their portion of it—is kept intact; the streams do not dry up; forest fires are prevented; small streams are sacred to the fingerling trout; the individual catch is limited to a reasonable number or weight; there are "rest days" for the fish, in which they gambol and leap and take flies without fear of a barbed hook; and the gray haired old sportsman who knew the virgin Adirondacks, as he passes through these parks, dreams of the old elysium, feels anew the thrill which in his younger days filled every nerve with delight.

Those who are inclined to rebel against the fact that men of wealth have appropriated the best parts of the Adirondacks and closed the gates to all but themselves and their friends have this to console them, that but for these rich men and clubs the same senseless and destructive abuse of the forest and fish

which has prevailed elsewhere would have devastated these preserved spots; that something has been rescued from the gross selfishness of the pot fisherman, the thoughtless greed of the so-called sportsman, the "worse than an infidel," who skulks along the little streams and murders the fingerlings, and that chief of sinners, the slashing lumberman. These portions of the forest have been, literally, "snatched from the burning." It will at least afford the sad-eyed outsider grim satisfaction to remember that some of the fish and game, bred and preserved here, escape to the yet open streams and forest which he may capture — if he can. He may have some liberal crumbs if not a full loaf, when, except for them, the crumbs would be lacking. Nevertheless, without further loss of time or opportunity, the State, and not individuals, should purchase all the remaining "choice places" and hold them in perpetual trust for all the people. That is the present pressing duty, the performance of which the "plain people" insistently demand.

The State is struggling against many obstacles, with a wider domain to look after and protect, with laws less effective than the regulations of private owners and clubs, to accomplish the same good purpose. Hatcheries, game protectors and foresters do much, but more stringent laws, well enforced, will aid much, and their aid is needed to carry out effectively the will of the people when they dedicated this State Park for the use of the people. It is of pressing importance to purchase detached tracts which now separate those already owned by the State. The laws already provide for it; let the appropriations follow. These parcels are increasing in value, and it is good business policy on the part of the State to purchase them at the earliest possible time. And while they thus divide the park into detached portions the difficulty of guarding the State lands is vastly increased.

The effects of dams upon rivers and outlets of lakes in the Adirondacks have been both disastrous and beneficial, so far as the pleasures of sportsmen are concerned. Two notable instances are the dam raising Cranberry Lake, constructed many years ago, the other of comparatively late construction on Beaver River where the Beaver River Club has its preserve. The former flooded a large tract of land, made the formerly beautiful lake a region of ghostly dead trees along the shores lined with the "groaning dead wood, in pain with every wave," and on the low grounds great swamps of tangled upturned roots and still standing dead trees, a veritable picture of nature's woe and despair. Time, however, has at length made the lake shores normal again, and the State has made a commodious passage way up the sluggish inlet to the mushroom town of Wanakena. Enlargement of the lake and the backing of the waters of the stream entering it made this body of water, by its size and other conditions, one of the best breeding



"JOE" DUNBAR.

grounds and fish food productive waters in the Adirondacks, where the largest trout grow and afford the finest sport yet remaining in the whole State. For a time it seemed as if fish pirates, lumbermen and increasing hordes of fishermen could not affect the fish production, but the time has at length arrived when even these grand waters are yielding to the inevitable effects of abuse and overfishing.

The Beaver River dam flooded the long valley through which the river used to wander and wind, with beauty and delight at almost every turn of its crookedness, and where the good fishing holes were, and numerous deer tracks on sandy points told of the nightly family gatherings by the grateful waters. The bushy, line-entangling alders, and the overhanging trees and all the green and lush vegetation, and bird songs, and camping places, and everything else at the memory of which the old sportsman's heart leaps, are gone, all gone, and a desolation indescribable has taken their place. Yet, the State is trying to redeem some portions of this dear old resort and has already removed some of the ugliness, and the lake that has been formed is becoming, and later on will become, a beautiful resort. For a time the trout lost their reckoning, could not find their old nesting beds, or discover new ones, and despairingly wandered about the flooded lands. At length they have found new homes for domestic life, learned where food abounds in the new conditions, and have become happy, large, fat and numerous. The fishing there was never better than now—but, then, the waters are protected.

The streams below the dams have also been benefited. The uneven flow in summer—especially since wholesale tree cutting destroyed so much of the spongy soil which used to be the regulator of the flow of the streams—has been regulated and the normal flow measurably sustained. Utilitarianism and the needs of the hungry mills below, in this case, have been the sportsman's friend.

One does not want to, and cannot if he wants to, fish all the while. Some days the trout seem to take a short vacation of a day or two (alas! sometimes a week or two), and often during the day they indulge in a siesta. Then is the time when that much-abused "camera fiend," who loves to take the beauties of forest and stream home with him for his winter's solace, gets in his work. In the days of dry plates—"films" not yet having been introduced—a camera carrying a glass dry plate, 5 by 8 inches in size, was almost invariably a part of the writer's luggage. It traveled over many a mile of trail and along many a stream, in the pack basket of a guide, and was almost always our companion in the canoe. When the fishing was dull, especially at the siesta hour of the trout, or whenever a particularly interesting and picturesque scene presented itself, the camera was elevated upon its three spindling legs, the loaded plate holder put in position, and the vision of beauty captured for the friends at home and for the

angler's own delight in the coming long winter evenings, when a sniff at the "tar oil" bottle, and a pipe of the fragrant weed, and the photographs, revived precious memories of happy days.

And then, too, the particularly good "catch" was photographed, furnishing indisputable evidence of the truth of the fish stories we told to our wondering friends—and skeptical stay-at-homes—the only disadvantage being that one had to be reasonably truthful, contrary to all precedent in the matter of fish stories. Camp scenes, also, were admirable subjects. The walls of the "den," snug and warm, where this article is being written while a blizzard is raging outside, this cold winter's night, are adorned with scenes of camp, lake, river, mountain, falls. The pictured outlines of a $3\frac{1}{4}$ -pound trout, taken with the fly at the "Glory Hole" on the upper Oswegatchie, almost seem to start into life in such company, and the broad tail—no, it doesn't move! It is the imagination and memory of his captor that revel in the scenes, but the trout is not dashing along the wall into that other picture, the beautiful river with its overhanging banks and cool retreats.

The big, heavy camera and glass plates have been stowed away. The kodak, with its films, fits the large loose pocket and does not expose the old sportsman to the quiet scorn of—the other sort of folks. When this lover of pictures gets home, he looks over his prints (he lets the photographer make them), selects those he loves best and has enlargements made of them. Look around these walls, and see if, after all, it doesn't pay to fish, even with a camera!

After all, what is the secret of this fascination of fishing in the Adirondacks which we old sportsmen feel; which makes us count the days when in February they begin to lengthen, and later we watch the reports about the ice going out? Is it the heat and discomfort of the hot July days that drive us out of our homes into the cool forest? Or, is there not something there that draws us thither? Is it the fishing alone; the fierce leap of the trout when the fly alights on the water; the thrill of the strike; the joy of the fight and victory; visions of full baskets, and the memory of rich, unique feasts?

These do, indeed, let us confess, draw us, and move us; but there is something still stronger—a haunting memory of a subtle something one never can quite define even to his own consciousness. The solemn forest, all the mysteries of sound, the low murmur of the pine leaves, the sweet odors of soil and vegetation, the silences, the glittering waters, the dark-hued pools, the hermit thrush's note at evening—a hundred other things we can name and label; but beyond all these there is something like the secret of what is life itself, which no mortal has ever solved. The humblest blade of grass, the tiniest insect, hides this



TWITCHELL CREEK.

LOOKING DOWN STREAM FROM THE FALLS.

sublime secret of life, and laughs at man's ineffectual effort to reach the mystery by observation, analogy or analysis. So with this secret of the forest's enchantment.

Better thus. All unknown but not unfelt the charm and mystic influence. Let us not pick our flower in pieces to find how and of what it is made. While we destroy the flower the secret escapes us—the life, the soul of this charm we would hold in our hands vanishes, like the odor of the flower. Let us enjoy the great beauty of nature with thankfulness, but without searching too curiously to know what her winning power is which she will forever hide from us.

Perhaps the most interesting feature of the Adirondacks is the mountains, hidden among which are some of the best fishing ponds and streams. Some of them standing alone are majestic in themselves. Others, in huge masses and rugged, crowd together in hordes. Climb one that towers well toward the sky—Blue Mountain, for instance—and gaze upon the marvelous plan which nature has wrought out, the map of her handiwork spread before you, the vast stretches of forest in every direction, the gleaming lakes hidden in valleys, now brought to view, the silver streams winding their devious ways, but, above all, the grand outlines of the true Adirondack mountains ranging off to the northeast. There are no Alpine heights with snowy peaks, to be sure, but many bold and bald heights where storms and strong winds and possibly great fires have raged and wrought desolation, and a scene of such imposing majesty as to move you, if you have the reverent soul, to lift your eyes to the heavens over you and feel in your heart of hearts a new reverence and worship for the power of which this majestic grandeur is an expression. On such a day as this on the heights, the lover of the great forest gets very near the elusive secret of his love. For this day, the minor delights and joys of his forest life recede and are silent for a while, and this heart communion with the deities of this rugged garden of the gods fills all his soul.

Blessed is the sportsman who can come now and then to this height of experience, and then descend to the common life retaining something of its inspiration. When again, in quieter scenes and in gentler ways, he, still a sportsman, but one who has seen visions and dreamed dreams, is tramping the shaded trails, or swaying his supple rod over smiling waters, or before the evening campfire talks with chosen companions and thinks of the themes of common life, there is a subconscious thought through it all, an undertone of feeling that came down the mountain with him hidden in the very soul of his soul. Of these he cannot talk; they are sacred, and henceforth, even if unconsciously, a part of his very life.

“It is not all of fishing, to fish.”

And how this fascination — rather, this love — persists. Other pleasures grow dull; the things which thrilled the nerves and made the blood hot with joy when youth and vigor were fresh and ardent cease to excite more than a languid interest when age creeps on apace; but as the old and wornout warhorse at the hurried beating of the drum and the clarion call of the bugle springs to his feet, ready for the charge upon the ranks of an unseen foe, so the "Old Adirondacker" at mention of his ancient haunts feels the old fire in his veins and his eyes gaze with a new light and longing off toward the forest scenes where his younger days were filled with an inexpressible joy.

Some years ago (alas! it is a quarter of a century ago) the writer perpetrated upon the public a little volume of personal experiences and observations in the Adirondacks. One chapter was upon a happy summer at "Jock's Lake" (now Honnedaga) in 1863 — his first taste of the Adirondacks. An old friend, who for many months had been painfully and hopelessly ill, heard of the little book, sent to the bookstore for it, and amid the racking, torturing, almost insufferable pains of his body, read and reread the simple story of "Jock's Lake," where he had spent some of the happiest days of his life. They said that while reading it he forgot his pain and seemed to live over again with undiminished enjoyment those other happy days. His grateful letter to the author also told it all. It was a revelation of the strength and persistency of the fisherman's love of forest and angling.

Another instance — but let this same little book tell it in a brief quotation. It happened (long ago, as we measure time in these days) at Paul Smith's, on the St. Regis:

"There was one learned old doctor and professor from New Haven who interested me very much. He was quite infirm, and his son, who accompanied him, with filial devotion anticipated every want. The brave old man was out early every morning, and with a guide rowed around the little rocky peninsula, southeasterly from the hotel, to the mouth of a cold stream that comes through the tamaracks into the lake not far beyond. There at the edge of the lily-pads (successors of those noted by W. C. Prime in his delicious volume, 'I Go A-Fishing,' on page 125), he skillfully and patiently cast his flies until he took the one big trout awaiting his morning call, and then returned to the hotel to breakfast and for the day.

"It was something more than a splendid trout that he brought to view as we met him at the landing. The young heart in the old body, the genuine enthusiasm of the veteran angler, the glorification of the gentle art which has soothed and comforted many an aged philosopher — all this he revealed to us, and we wanted



ON THE BEAVER RIVER.

BEFORE THE SCENERY WAS DESTROYED BY THE STATE DAM.

to lift the grand old man to our shoulders and bear him in reverent triumph up the ascent."

Possibly the "sportsman's view"—especially if he is past the age when Dr. Osler says he should be chloroformed—may be extended to another subject which concerns him indirectly, but very much. He will venture to "say his say."

By the terms of section 7, Article VII, of the Constitution of 1894 the lands of the State, then owned or thereafter acquired, within the limits of the Forest Preserve, are forever to be kept as "wild forest lands." "They shall not be leased, sold or exchanged, or be taken by any corporation, public or private, nor shall the timber thereon be sold, removed or destroyed." This new provision of the Constitution outlined and fixed the policy of the State with reference to these lands.

Chapter 220, Laws of 1897, created a Forest Preserve Board and provided for the acquisition of land and waters and structures within the territory embraced in the Adirondack Park, or such portions thereof as such board may deem it advisable to acquire for the interests of the State. The board was given the power by a quick and simple proceeding to take, and reduce to immediate possession, such lands, etc., and to adjust the claims of the owners if they can be agreed upon. If they are unable to agree with the owner for the value of the property and the damages for taking it, the owner is given the right to go to the Court of Claims and obtain judgment therefor.

This power to appropriate real property, so vested in the Forest Preserve Board, is limited to the appropriation of real property adjoining land already owned or appropriated by the State at the time the description and certificate (for the new appropriation) are filed in the office of the Secretary of State; "*except that timber land not so adjoining State land may be appropriated whenever in the judgment of the board timber thereon, other than spruce, pine or hemlock, is being cut or removed to the detriment of the forest, or the interests of the State.*"

The owner of land taken under the act of 1897 may at his option, to be exercised within certain limitations, reserve the spruce timber thereon ten inches or more in diameter at a height three feet above the ground; and land acquired by purchase may be taken subject to the reservation of the soft timber thereon down to eight inches in diameter on the stump with the right to remove the same. There are various restrictions on this reservation of timber and the exercise of the right; notably, *the reservation does not include or affect timber within twenty rods of a lake, pond or river*, and such timber cannot be reserved. By chapter 94, Laws of 1901, the Forest Preserve Board was abolished, and its powers (herein set forth) granted to the Forest, Fish and Game Commission; and two Commissioners of the Land Office may be designated to act with them.

It may be presumptuous, but perhaps not unpardonable, to comment somewhat suggestively upon some of these, in the main, most commendable provisions of the Constitution and statutes. The judgment of the Constitutional Convention and the Legislature solemnly expressed in Constitution and statute, doubtless took into account facts and conditions existing at the times of their enactment not readily ascertained or wisely considered by the general observer.

In the laudable zeal to forever preserve the Adirondacks as "wild forest lands," for economic reasons, the important economic fact seems to have been forgotten, or its importance minimized, that the forest contains and continually produces a vast wealth of timber much needed for both public and private uses and doomed under the provisions of the Constitution to inevitable decay, some portions of which might be removed, under wise regulation and strict supervision, without injury or detriment to the forest, its waters, its beauty or its productiveness as affecting the great rivers it feeds. The revenue that might be derived from utilizing the surplus timber would go far toward relieving the State treasury of much of the burden of administering the State's supervision of the Adirondack Park, and enabling the State eventually to acquire substantially all the lands within the borders of the Preserve.

It seems quite possible that at no remote period the constitutional provision that the timber on the Forest Preserve shall not be sold or removed will be modified so as to permit sale and removal of some portions under such restrictions as will practically leave the Preserve "wild forest lands."

It is very fortunate for all except the younger sportsmen that here and there throughout the Preserve there are private lands on which hotels and cottages have been and, as years go on, will be erected. They supply one great and important want of the people, and do not destroy, or tend to any great degree to destroy, the beauty or public use of the Preserve. The Fulton Chain of Lakes, Lake Placid, St. Regis Lake, Cranberry Lake, and many other lakes afford examples amply illustrating and supporting this view. The few facilities for this sort of use of the forest and its waters at Raquette Lake lead one to surmise what a misfortune it would be if throughout the Preserve no structure could be erected better or more ample than a tent.

The wise policy of the Forest Preserve Board, and the Commission which succeeded it, in not seeking to appropriate by condemnation these lands and structures so occupied, notwithstanding its legal power to do so, is doubtless founded in a due appreciation of the benefits, to the people as a whole, of the existence of this private ownership, and improvement by way of cottages and hotels, of these practically exempted lands. Fortunately, public opinion and the evident



LITTLE RAPIDS, BELOW MUNCY'S HOTEL.

ON THE BEAVER RIVER.

benefits of such a condition have sustained the Board in its recognition of the simple fact that, after all, it does not best serve the State or the people of the State to make *all* the Preserve "wild forest lands."

And this leads to the further thought and questioning whether or not some carefully restricted and fairly exercised power should not be given to the Commission, in some future amendment to the Constitution—a power, possibly, to be exercised through an application to the higher courts—for the leasing, for moderate periods, of points of land upon some of the lakes, for hotel purposes or cottages, or both. This would be but an extension of the present policy which permits owners of private lands to retain their hotels and cottages in seeming violation of the intent of the Constitution to reduce the entire Preserve to "wild forest lands"—an intent which, if strictly carried out, would make it a "wilderness" indeed to three-fourths of the people who now enjoy its benefits.

It might be supposed that one who ventures to pose as a "sportsman" and to give his "view" of fish, would have some expert and scientific knowledge of ichthyology in general and of Adirondack fishes in particular, but he confesses that he is one of those who go to the woods and waters principally to rest and enjoy and not so much to learn; that he loves the trout fisherman-wise and gastronomically, and to this day calls him *Salmo fontinalis* although he reads that he ought to say *Salmo salvelinus*; and although in his boyhood days he wrestled with Cicero's native tongue, he prefers plain "brook trout" to either. Yet he knows he is wrong and ought to be scientific in his nomenclature if he would be understood outside of his own bailiwick.

He attempts, however, although conscious of his deficiencies, but borrowing from others who know, to give some facts about Adirondack fish in general for the possible benefit of some reader who is not already familiar with them. He is amazed at the outset to see how even scientific authorities differ in their scientific nomenclature of fishes, while the varieties of the common names of the same fishes in different localities are utterly confounding. It will be better to steer clear of difficulties by giving only a few names of well-known fishes than to plunge into the deep waters of a critical essay on the subject.

Fred Mather, that genial gentleman and wise sportsman who wrote fascinating books on fishing, at the request of Verplanck Colvin, Superintendent of the New York State Adirondack Land Survey, in 1882, made a serious and protracted attempt by actual investigation to learn all about and describe scientifically the fishes inhabiting the Adirondack waters, and made a very full and clear report, published in Colvin's Report in 1891. Careful use here is made of Mather's article and of some later authorities.

The "Family Salmonidae" is first in importance, embracing as it does the original and most esteemed game fish of the Adirondacks, and some cousins of his later introduced.

At the head of all stands the "brook trout" or "speckled trout" (*Salmo salvelinus* or *fontinalis*), native to nearly all the Adirondack waters. The "rainbow trout" of California (*Salmo irideus*) and "brown trout" of Europe (*Salmo fario*) have been introduced in late years, and thrive under the same conditions as the brook trout, and are not distinctively unlike the brook trout as game fish. The rainbow trout seems to thrive as well in deeper and warmer waters than brook trout require.

The "lake trout"—erroneously called "land-locked salmon," "salmon," and "salmon trout"—(*Salvelinus namaycush*, also *Cristivomer namaycush*), as their names imply, inhabit a number of lakes. They require colder water than the brook trout and are usually found only in the deepest waters of those lakes which have a depth of forty or more feet. In the early spring, however, while the water is cold, they are found in shallow water near the shores and then are easily taken by trolling, and they sometimes rise to the fly. In the summer they must generally be fished for in deep water. In Fourth Lake, Fulton Chain, and perhaps in other lakes, they are taken in the summer by deep trolling. They are usually of good weight, from four to ten pounds, often weighing fifteen to twenty, occasionally much more. It is an excellent food fish.

The "frost fish," sometimes called "white fish" (*Prosopium quadrilaterale*), belongs to the salmon family, and is a good food fish. It does not take the hook and is usually captured in the fall, in traps or nets, while running up the brooks to spawn.

The "Family Centrarchidae," or bass family, are next in importance as game fish. Only one variety, however, is known to have been introduced into the Adirondack waters, namely, the "smallmouth black bass" (*Micropterus bolomieu*), not native to any of these waters, but introduced into many of them, notably in Raquette Lake and the Fulton Chain of Lakes, and wandering into others. As a game fish it deserves high rank, averaging a larger size than the brook trout, taking the fly readily, and making a gallant fight when hooked. Its cousin, the "Oswego bass," or "largemouth black bass" (*Micropterus salmoides*), resembles closely the smallmouth variety, and possibly has been placed in some of the lakes.

The troublesome "rock bass" (*Ambloplites rupestris*), a nimble biter in waters where his gamier relatives exist, does not infest the Adirondacks. But the still humbler member of the bass family, the "sunfish," or "pumpkin seed" of our



LAMONT'S HOTEL, ON SMITH'S LAKE (LAKE LILA).

THESE BUILDINGS WERE TORN DOWN IN 1893.

boyhood experience (*Eupomotis anvens*), is found in great numbers, with the same bad habit of "taking the bait" which characterizes him in the outside waters.

The "Family Esocidæ," or "the pikes," are not native to the Adirondacks, but unfortunately, through ignorance and sometimes through malice, have been placed in waters inhabited by trout, proving to be among the most destructive enemies of that royal fish. The true "pike" (*Esox lucius*) and the "pickerel" (*Esox reticulatus*), a smaller fish of the *Esox* family ("pickerel" properly meaning "a little pike"), are often confounded with each other. The pike was found by Mather in Long Lake and Forked Lake, but now exists in quite a number of lakes. It is believed that the pickerel (*Esox reticulatus*) also has been placed in some Adirondack lakes. Guides and sportsmen usually, perhaps universally, apply the name "pickerel" indiscriminately to both varieties, and always in emphatic deprecation.

The "Family Siluridae," "the cat fishes," are represented in Adirondack waters by the "bullhead" (*Amiurus catus*). They thrive best in sluggish waters having muddy bottoms. The fisherman for trout abandons his "choice spot" when the bullhead begins to take his bait. It is an excellent food fish when properly cooked.

The "Family Anguilla," "the eels," has one representative in many Adirondack waters, "the common eel" (*Anguilla rostrata*), although its presence is hardly ever suspected by or made known to the sportsman.

The "Family Calostromidae," "the sucker." Of these, four varieties were found by Mather in abundance in the Adirondacks—the "long nosed," "common," "June" and "dwarf." They bear a great variety of common names. In the Adirondacks they are of value as food for other and better fishes.

The "Family Cyprinidae." In this "family" there are over a hundred genera, and nearly a thousand species. "In the Old World," says Mather, "there are several species of this family which grow to good size and are recognized as game fish. In America there is but one species which grows to a size that entitles it to the notice of the angler. This is the 'big chub,' 'fall fish,' 'roach,' etc. The other members of the family are lumped together in the popular nomenclature as chubs, dace, shiners and that name which covers a multitude of fishes, 'minnows.'" These smaller fishes are very abundant in most Adirondack waters and constitute the most important fish food upon which the existence of the trout and bass families largely depends. In lakes or streams where they do not abound, or other sufficient live food supply is not furnished, these noble game fish cannot live. The memory of many a gray-haired sportsman goes back to his juvenile days when with pin hook and tow string he had his first piscatory

triumphs and joys at the foot of some mill dam with these same despised but useful little chubs, dace and shiners, and some of them still serve him as bait.

Other fish food for the smaller fish found in the Adirondacks are insect larvae—of mosquitoes, “black flies,” gnats, midges and “punkies.” The larva of the helgramite fly is a famous bait for the black bass. The common crayfish and the little “fresh water shrimp” are excellent fish food, especially the latter, which forms an important part of the food of the trout family.

The life of the fishes is in constant peril from natural enemies. The aquatic birds—loons, herons, fish eating ducks, kingfishers, fishhawks, and others—wage constant warfare upon them. The otters and minks unrelentingly pursue and destroy them. The fishes themselves are cannibals, devouring their own unborn babies in the egg and the helpless infants of their families, and by instinct the stronger devour the weaker. The savagery hidden under the calm surface of the waters parallels that upon the land among human savages. Nature, to meet those destructive agencies, has given to the fishes marvelous reproductivity, and the races and families, genera and species survive and flourish, holding an equilibrium of existence practically undisturbed—until man comes with new modes of destruction. Then Nature is defeated in her wisely adjusted plan. The equilibrium is broken up.

Just here is where the wisdom of the law comes in to check the indiscriminately destructive work of man, and to help restore the fast failing powers of the hard pressed hosts of the fish kingdom to their true place and rank in the economy of nature.

So, it is one of the most important departments of the work of the Forest, Fish and Game Commission so to administer the laws of the State and aid the laws of nature as to return to nature what the thoughtless greed of man and his unwise use of nature's gifts have rudely taken from her.

The Albino Brook Trout*

BY CLIFFORD R. PETTIS, F. E.

AT the various fish hatcheries of this State there have appeared in the regular hatch of fry from eggs of both wild and domesticated brook trout, fry which were white. They have naturally been called albinos. In some cases they have been selected and reared separately. At other times they have been raised without any particular care, planted with the general stock, and been lost to notice.

The albino brook trout is a form of our common brook trout, the *Salvelinus fontinalis*. It differs from the regular form only in color. Its skin is a creamy white, mottled or barred with brownish yellow, the white on the ventral side shading to the darker color of the dorsal portion. The dorsal and caudal fins are yellowish, while the lower fins are light colored. The eyes are pink.

Albino Trout in this State.

The first authentic record of albino trout in this State that I am able to find were those raised by the late James Marks, then foreman of the State Hatchery at Caledonia. About 1875 some albino fry appeared among the hatch of that season, from which a female fish was raised that lived to be six years old, and attained a length of about eleven inches. When she was three years old she produced eggs. Having no albino male, her eggs were fertilized by an ordinary brook trout. The fry produced were mostly straight brook trout, but a few, however, were albinos. All record of the fry thus hatched has been lost. Albinos have appeared at this hatchery from 1880 to 1888, the number varying from 15 to 300 in a season. No particular attention was paid to them, and they were planted with the others. Albino brown trout have also been hatched at the Caledonia Hatchery.

At the Fulton Chain Hatchery, albinos appear nearly every season both among the lake and brook trout fry. Foreman Davidson, in 1902, saved five from the fry hatched that spring out of 300,000 brook trout eggs. Four of these lived and were liberated with the other fingerlings in the same year.

* A portion of this article appeared in a contribution by the same author to the June number of Science, 1904, and is reprinted here by permission.

The late Seth Green, who for many years had charge of all the fish hatcheries of this State, wrote an article in 1885 from which the following extract is taken. "Another curiosity which is sometimes seen in the propagation of fish is the albino, as perfectly as could possibly be imagined, pure white with pink eyes. They are quite rare, probably not more than one making its appearance among a million fry. On several occasions we have kept them until they were several months old, and four until they were two years old, when all but two were caught by kingfishers. They are such a perfect mark and can be seen so much easier than other trout that they are easily caught. One was raised until it was three years old when unfortunately it died, much to the regret of all as it was a great curiosity to visitors. From this fish we took 300 eggs and impregnated them with ordinary brook trout. A good percentage of the spawn hatched, but the young showed no differences from the ordinary fry.

Albino brook trout were raised at the Sacandaga State Hatchery from eggs taken from wild fish. At least one of these fish lived to be two years old.

At the Adirondack Hatchery, Saranac Inn, albinos have hatched nearly every year. In March, 1902, there were about fifty of them from an entire hatching of 800,000 eggs taken from both wild and confined brook trout. As there were so many they attracted attention and were put by themselves. They received the best of care, but only four lived. Two of these are typical specimens, conforming to my description, while the other two are without the colored spots. Color, silvery; black eyes, and appear to be barren fish. They have all been kept in the races at the hatchery and fed on ground liver. One of the pure albinos is a male and the other a female. November 10, 1903, when the two albinos were twenty months old, they were stripped for eggs and fertilization. At that time their combined weight was approximately one half pound, the female being much the larger.

Foreman Winchester made the following experiments in fertilization: First cross, 527 eggs from female albino x albino male; second cross, 103 eggs from female albino x natural male; third cross, 424 eggs from natural female x albino male. The eggs, after fertilization, were placed in the hatchery races the same as done with all brook trout eggs. The hatching began March 1, 1904, and continued until the thirteenth of the same month, the period of incubation being the same as that for the other trout eggs. The results of the hatching were as follows:

First cross, . . .	32 hatched, . . .	approximately 6 per cent.
Second cross, . . .	43 hatched, . . .	approximately 42 per cent.
Third cross, . . .	416 hatched, . . .	approximately 98 per cent.



Light jockey trout

Quincy

The fry from the pure albino strain all died within sixty days from time of hatching. Their characteristics of color were pure albino. Their weakness is indicated in that only six per cent of the eggs proved fertile, and that several of the fish were imperfect. Those that hatched from the second cross all died within thirty days. Those from the third cross are all living and making a fine growth. As the fry from the eggs of the pure albino female lived so short a time it would indicate her weakness.

On the other hand, the eggs of a wild trout fertilized by the albino male produced a higher percentage of fertile eggs than is generally secured in fish culture. One hundred of the fingerlings from the third cross were given to the Carnegie Institute, for research work at their laboratory, Cold Spring Harbor, N. Y. The fry from both the second and third crosses resembled almost entirely their natural parents, the albino characteristics having practically disappeared.

Some fry from both ordinary trout and the pure albino were sent to Dr. Charles K. Winne, Jr., of the Bender Laboratory, Albany, N. Y., who made a microscopic examination and reported as follows: "The ordinary fry contain an abundant layer of pigment in and just beneath what would correspond to the epidermal layer in human skin. In the albino fish there is absolutely no appearance of pigment anywhere." Hence it is conclusive that this difference of color is simply one of presence or absence of pigment under the outer skin. These fish were exhibited at the State Fair, in Syracuse, last fall, where the male died on account of someone shutting off the water supply from the tank. The male at that time had reached a length of nine inches. The female is now ten and one half inches long, and will weigh about half a pound.

Albinos at Private Hatcheries.

Mr. James Annin, Jr., proprietor of the Caledonia Trout Ponds, says: "I have had quite a number of albino brook trout hatch in past years, but have no memorandum on this subject. In 1902 I had four or five fine albino yearlings that I raised from fry. In the spring, when they were yearlings, we placed them with some brook trout yearlings in a tank provided with plenty of shade. But with all our care, as they were so conspicuous, the kingfishers got them all before they had been in the tank a week. I have hatched albinos from both wild and domesticated brook trout. I have also hatched albino brown trout. These fish were a creamy white with pink eyes. At my Randolph Hatchery, in 1899, I had an albino brown trout that weighed nearly three pounds. I gave this fish to

the New York Aquarium. The albinos mentioned above were strong, and perfect in every way, and fully as large as any of the fish from the same hatch."

At the Combs Brook Hatchery, belonging to the Adirondack League Club, out of 300,000 brook trout eggs hatched in 1897 there appeared four pure albinos. One of these lived to a year old, and reached a length of five inches.

Mr. A. W. Marks, who has had charge of private hatcheries at Cedar Island, Wis., at Detroit, and now at Munising, Mich., says: "We find more or less albinos among our fry, but more among the salmon or lake trout than among the brooks. One season at Cedar Island we hatched 100 of these fish. They were the pure albinos with pink eyes and white flesh, the fins tinged with pink. The eggs were taken from wild brook trout. The fish were raised with our brook trout until planted, and were as healthy and grew as rapidly as the others."

United States Hatcheries.

Mr. Livingstone Stone, Superintendent of the United States Fisheries Station, Cape Vincent, N. Y. author of "The Domesticated Trout," says: "About one albino trout appears from a million eggs that are hatched, and always from domesticated fish. I never saw pure albinos except from the ordinary eastern brook trout. My fish died soon after beginning to feed, and had attained the same size that brook trout of that age reach."

Albinos in Other States.

Correspondence with several commercial fish hatcheries in Massachusetts brings different replies. In some cases they never heard of an albino, while others say they have a few each year. They gave them no particular attention and they disappeared with the others.

The Minnesota State Fish Hatchery, at St. Paul, has had remarkable success in the propagation of these fish. In 1893 they got three albinos from the fry hatched that year. Two of these died later and one reached maturity. Two years later three or four were found, and two of these reached maturity. From this beginning they now have some 25,000 eggs, about 10,000 fry, and perhaps 500 adults of all ages. The first albinos hatched came from pond fish which were raised from wild ones. Mr. S. F. Fullerton, Executive Agent, advises me that they fertilize the albino egg with milt of the albino male, and that the result is pure albinos every time. A dark fish has not appeared among them in several years. They propagate them entirely from this strain, the fish being all domesticated and fed on liver. They make the same growth as the native brooks and are just as

game; in fact, he thinks the young are more lively than those of the brook trout. Mr. Fullerton tested their gameness and ability to secure food by throwing minnows to Scotch, German brown spotted, rainbow, native brook and albino trout and steelhead salmon. The albino got their minnows quicker than the other varieties. At St. Paul they have tried experiments in crossing back, taking the female native brook trout and the male albino, also *vice versa*, but they have never been able to propagate any white ones from this experiment. They always tone back to the original.

Commissioner Meehan, of the Department of Fisheries, State of Pennsylvania, writes as follows: "Several years ago a few albino trout appeared in a hatchery at Corry four or five years in succession. One year there were about one hundred, but in other years there were not more than half a dozen. This was at least twelve or fifteen years ago, when the annual output of the hatchery was about a million and one half. Since then they have not appeared at Corry, and there has never been any albinos at the other hatcheries. They were all hatched from impounded fish eggs, and never from wild fish. You will notice from the above that the percentage of albinos was very small. They were all pure albinos with pink eyes. Apparently the albino thrived as well as the ordinary trout, except that their growth was not as rapid. We have never had albinos among fish other than trout. We are now raising about seven millions of trout annually, and from the fact that we find no albinos among them their rarity is indicated."

Hon. W. H. Venning, for twenty-two years Inspector of Fishing and Fish Hatcheries in Nova Scotia and New Brunswick, writes that he never saw an albino trout, and that my letter asking for information was the first intimation he had that such a fish existed.

Correspondence with many noted fishermen indicates that if albinos exist among wild fish they are rare, as none of these gentlemen ever saw one.

Albinism and Color in Animals.

Albino is a term first applied by the Portuguese to the white negroes of West Africa, but now applied to any individual in which there is a congenital deficiency of pigment in the skin, hair, iris and choroid of the eye. The skin is abnormally pale, the hair is white or pale flaxen, and the iris is pink. Animals thus affected are albinos. The absence of pigment in the iris renders the eye of an albino sensitive and partially blind in the sunlight. Mr. Livingstone Stone thought that his albinos were blind; but probably it was only the absence of pigment in the iris which caused them to appear blind. Albino brown trout raised by the State

in the Caledonia Hatchery were put in outdoor ponds when they were yearlings, where the sunlight caused their eyes to bulge out of their heads, and the fish died in a short time.

Albinism is a condition known among all races and all people; hence, neither climate nor race are its causative factors. The most widely accepted theory is that the condition is due to the arrest of the development of the pigment layer in the embryo. Cushing found it frequently among the Zuni and other tribes in Arizona, and its form was not confined to man, but occurs frequently among rabbits, mice, birds, and other lower animals as well as in plants. An albino is usually considered a sport or freak of nature—e. g., when one of a brood of crows or blackbirds is white—but albinism tends to become hereditary and establish itself, as in white mice, white rabbits, and white poultry. Similarly, albino brook trout have become established at the St. Paul Hatchery. Albinos are distinguished from animals that are naturally white, as the snowy heron or polar bear; also, from those that are periodically white, as the arctic fox and polar hare. Some animals are more susceptible to albinism than others, but probably all are liable to have this deficiency or total lack of pigment which constitutes the affection. Among the mammals, albinos are not uncommon among our Adirondack deer, woodchuck, hedgehog and a few others.

The opposite of albinism, melanism, occurs when there is an undue development of coloring matter in the skin and its appendages. We refer to this condition in people by saying, "they have a very dark complexion." Among the animals it is noticed in their pelage and in the plumage of birds. It occurs frequently in some groups—e. g., squirrels and hawks; sometimes it becomes an inherent specific character, as in the black rat (*Mus rattus*), which is believed to be a permanent melanism of the white-bellied rat. The black squirrel appears as a form of the red squirrel.

Albinism and Change of Color in Fish.

There are very noticeable differences in the color of fish caught from different waters. These differences of color are usually caused by one or more of the following conditions:

DEPTH OF WATER.—Deep water is darker, and the fish become darker through adaptation to their surroundings. Similarly, shallow water is lighter and the fish are lighter colored.

NATURE OF THE BOTTOM.—Fish that live in bodies of water that have a light-colored bottom have a tendency to be light colored, while those in waters that have a dark-colored bottom are darker.

SHADE.—Fish in water that is densely shaded are darker than those living in the open under similar conditions.

The breeding season produces periods of changes in color.

The amount of food and kind of food are said to produce changes in the color of the fish.

Certain waters seem to be particularly adapted for trout, and in some waters a large number of minute hydra exist which is thought to produce a greater number and more intense coloring of the small red spots on the sides of the fish.

These changes are accounted for by an increase or decrease of the black, red, and yellow pigment cells or chromatophores in the skin of the fish; or by rapid contraction or expansion of the chromatophores which happen to be developed. Black chromatophores predominate in a fish which lives in deep water on a black bottom. This is an example of the melanic form. Fish that live in shallow water with light-colored bottom have the pale chromatophores predominating. These differences in depth of water, shade, and nature of the bottom would have no effect in producing changes in the color of albinos, as they have no chromatophores.

An ordinary fish can be changed in color by an experiment in an aquarium. If the light coming from above, to an aquarium, is cut off and all light is admitted from below, thus reversing the usual direction of the light ray, the fish will become light on the back and dark on the belly. This would seem to indicate that the color of fish is due in part to the direct effects of light, a fact which has been denied. The different colors of fish are produced by different colors of pigment in their skin, the same as different races of people are distinguished by the different colors of their pigments. Many fish living in caves, but not all, have lost their color and become white and limpid; but in the deep sea, where no light comes, the fish are said to be usually pearly or black.

Dr. Gunther, in his book "Introduction to the Study of Fish," says: "Total absence of chromatophores in the skin, or albinism, is very rare among fish; much more common is incipient albinism in which the dark chromatophores are changed into cells with a more or less intense yellow pigment. Fishes in a state of domestication, like the Crucian carp of China, the carp, the tench, and the ide, are particularly subject to this abnormal coloration and are known as the common gold fish, the gold tench and the gold orfe. But it occurs also, not rarely, in fishes in a wild state and has been observed in haddock, flounders, carp, roach and eels. The amount of variation is greater in fish than in any of the higher class of vertebrates. Greater in some families than in others. Naturally greater in the few species which have been domesticated."

Besides the albino forms of brook, lake, and brown trout to which I have referred, the United States Fish Commission has reared to adult form albino landlocked salmon. As they did not prove productive under domestication the experiment was abandoned.

There are some reasons why albino trout will never become common as a wild fish. First, there are the natural enemies of fish, such as the kingfisher and blue heron (crane), which live on fish they catch from the water. The albino being so noticeable, on account of its color, is most likely to be caught. I have already related a few circumstances where this has occurred. The Pennsylvania Department of Fisheries received about two hundred albinos from the Minnesota Commission last summer, and Commissioner Meehan says: "I am sorry to say all of them were devoured by cranes in a single day while the employees of the hatchery were at their dinner." On account of their color, they would be a prey of the other fish in the same water. Their rarity is another factor. Judging from the success of the Minnesota Commission there is no doubt but that they can be propagated, and will be able to secure their food in competition with other fish. Their chief value seems to lie in their beauty as a fish for exhibition purposes.



Description of Colored Plates

Channel Cat

Channel Cat (*Ictalurus punctatus* Rafinesque).

Ictalurus punctatus JORDAN, Bull. Buffalo Soc. Nat. Hist., 95, 1876; JORDAN & GILBERT, Bull. 16, U. S. Nat. Mus., 108, 1883; JORDAN & EVERMANN, Bull. 47, U. S. Nat. Mus., I, 134, 1896, pl. XXV, fig. 58, 1900.

This species is variously styled the channel cat, white cat, silver cat, blue cat and spotted cat. It is found over a vast extent of country, including the Mississippi and Ohio Valleys and the Great Lakes region. In the Eastern States it is absent from streams tributary to the Atlantic, but occurs from Vermont south to Georgia, westward to Montana, and southwestward to Mexico. In Pennsylvania it is limited to the Ohio and its affluents.

The adults of this species are bluish silvery, and the young are spotted with olive. It is one of the handsomest of the family of catfishes and an excellent food fish. The spotted cat grows to a length of three feet and a weight of twenty-five pounds. It is extremely variable in color and in number of fin rays, and has consequently been described under more than twenty different names. It is most abundant in large, clear streams. The species is less hardy than most of the other catfishes.



CAVPIEI LUTUOTUOUII LUTUOTUOUII

Wentz



Red Horse

Red Horse (*Moxostoma aurcolum* LeSueur).

Catostomus aureolus DEKAY, N. Y. Fauna, Fishes, 201, pl. 42. fig. 133, 1842.

Moxostoma aureolum JORDAN & GILBERT, Bull. 16, U. S. Nat. Mus., 140, 1883; BEAN, Fishes Penna., 30, 1893; JORDAN & EVERMANN, Bull. 47, U. S. Nat. Mus., I, 192, 1896.

The red horse has the additional names of golden red horse, golden sucker, mullet, golden mullet, and lake mullet. It inhabits the Great Lakes and the region northward, also the Ohio Valley. It is common in Lake Erie, but not in Ohio.

This species grows to a length of 18 inches and is one of the handsomest of the suckers. Prof. Forbes records it from lakes of Northern Illinois, also abundantly in the central part of that State.

Dr. Evermann, in collecting fishes of the Lake Ontario region, secured it at the following localities: Lake Ontario, four miles off Nine Mile Point, N. Y., June 12, 1893; Lake Shore, three miles west of Oswego, July 17, 1894; mouth Salmon River, July 25, 1894; Long Pond, Charlotte, N. Y., August 17, 1894; Sandy Creek, North Hamlin, N. Y., August 20, 1894.

DeKay records the species as very common in Lake Erie. In August and September he observed them to be full of worms. In his New York Fauna, Fishes, p. 198, he describes a sucker or mullet under the name Oneida Sucker. This he stated is common in Oneida Lake. The species is considered identical with *Moxostoma aureolum*. His description shows a very close agreement with that of *aurcolum*.

The food of the red horse consists chiefly of mollusks and insects. It is not a choice food fish.

Eugene Smith records this form as occurring in the vicinity of New York City. Mention has already been made of the doubt concerning the northern limits of the range of *macrolepidotum*; but for the sake of comparison the brief description of *macrolepidotum* published by Jordan & Evermann is given herewith.

Head moderate, rather stout, its length four and three fifths in body; eye one and two thirds in snout; dorsal fin with its free edge concave; scales usually with dusky shade at base; lower fins pale. Streams about Chesapeake and Delaware Bays and southward to North Carolina. It seems in some respects intermediate between *M. aureolum* and *M. crassilabre*; we cannot at present identify it with either.





Crappie

Crappie (*Pomoxis annularis* Rafinesque).

Pomoxis annularis BEAN, Fishes Penna., 103, pl. 30, fig. 59, 1893; JORDAN & EVERMANN, Bull. 47, U. S. Nat. Mus., 987, 1896, pl. CLIV, fig. 415, 1900.

Color clear silvery olive, the sides mottled with dark greenish blotches. On the upper part of the body are traces of narrow vertical bars. The dorsal and caudal are mottled, but the anal is usually uniform pale.

Among the many names which have been applied to the crappie are: Bachelor, newlight, campbellite, *Sac-a-lait*, bridge perch, strawberry perch, chinquapin perch, speckled perch, tin perch, goggle-eye, John demon, shad, white croppie and timber croppie.

The crappie is a very general favorite for pond culture, can be readily transported and under favorable conditions multiplies prodigiously. Its range has been very much extended by artificial means. The best distinguishing marks between the crappie and the calico bass are the more elongated form of the crappie, the presence of six spines in the dorsal and the nearly uniform whitish color of the anal. In the crappie the greatest depth of the body is usually contained two and one half times in the total length without the tail, while in the calico bass the depth equals one half the length. These two species are so similar in size and habits that they are rarely distinguished except by ichthyologists.

The crappie grows to a length of about one foot and usually weighs one pound or less, but in a lake near St. Louis an individual weighing three pounds has been recorded.

Crappie fishing usually begins in June and lasts till the coming of cold weather. Large numbers of these fish are collected near Quincy, Ill., for distribution to other waters. At Peoria, Ill., Prof. Forbes has taken them in March and April; he has found them also in Pistakee Lake and at Ottawa. Cedar Lake, Ind., and Kings Lake, Mo., are celebrated crappie waters. Near Covington, Ky., in private ponds belonging to Joseph Schlosser, there are myriads of crappies as well as other game fishes.

The crappie is a very free biter and can be caught readily with minnows or worms. Spoon bait has been successfully used in trolling for this species. It is recorded that two men have taken a thousand crappies in three days' fishing with hook and line. As the fish is gregarious, congregating in large schools, and fearless, it can be taken in the immense numbers given. The best bait for crappie is a small shiner. It rises well also to the artificial fly. As a food fish this is one of the best in our inland waters, and its adaptability for life in artificial ponds should make it a favorite with fish culturists.



Centropomus undecimradiatus (Pom.)

Denton

Goldfish

Goldfish (*Carassius auratus* Linnæus).

Cyprinus auratus DEKAY, N. Y. Fauna, Fishes, 190, 1842.

Carassius auratus JORDAN & GILBERT, Bull. 16, U. S. Nat. Mus., 253, 1883; BEAN, Fishes Penna., 54, pl. 25, fig. 43, 1893.

The common goldfish or silverfish is a native of Asia, whence it was introduced into Europe and from there into America, where it is now one of the commonest aquarium fishes and is extremely abundant in many of our streams. In Pennsylvania it abounds in the Delaware and Schuylkill Rivers.

DeKay made the following remarks about the goldfish, or golden carp, as he styled it:

"The golden carp, or goldfish, as it is more generally called, was introduced from China into Europe in the early part of the seventeenth century, and probably shortly after found its way to this country. They breed freely in ponds in this and the adjoining States. They are of no use as an article of food, but are kept in glass vases as an ornament to the parlor or drawing room. They are said to display an attachment to their owners and a limited obedience to their commands."

They are introduced into lakes, ponds, fountains and reservoirs generally. An individual was kept in a fountain at Forty-second Street and Fifth Avenue, New York, by Patrick Walsh nine years and was then presented to the aquarium.

At Cold Spring Harbor Hatchery, L. I., several varieties were hatched from the same lot of eggs. These included the normal form, the typical fan-tail, and one which was so deep bodied that it could scarcely balance itself in swimming.

The goldfish in the New York Aquarium were never troubled by fungus parasites.

"In many of our streams and ponds, the goldfish has run wild, and hundreds of the olivaceous type will be secured to one of a red color. In the fauna of the moraine ponds and in quarry holes, the goldfish stands first. It will breed in foul water where only catfish and dogfish (*Umbra*) can be found." *Eugene Smith*.

The goldfish is extremely variable in color and form. It is usually orange, or mottled with black and orange, yet in some streams and even in pond culture, silvery individuals are often more common than any of the mottled varieties. The species grows to the length of twelve inches. It spawns early in the spring and is subject to many dangers and is attacked by many enemies. The fish, however, is extremely hardy, prolific, and tenacious of life.



Quintus

GOLDFISH (CARASSIUS AURATUS)

Carp

Carp (*Cyprinus carpio* Linnæus).

Cyprinus carpio DEKAY, N. Y. Fauna, Fishes, 188, 1842; JORDAN & GILBERT, Bull. 16, U. S. Nat. Mus., 254, 1883; BEAN, Fishes Penna., 55, pl. 1, colored, 1893.

The carp is a native of Asia and has been introduced into Europe and America as a food fish, chiefly for pond culture. It thrives in all warm and temperate parts of the United States, and reaches its best condition in open waters. In Texas it has grown to a length of twenty-three inches in eleven months after planting. The leather variety is most hardy for transportation. Mr. Hessel has taken the carp in the Black and Caspian Seas; salt water seems not to be objectionable to it, and it will live in stagnant pools, though its flesh will be decidedly inferior in such waters. The carp hibernates in winter except in warm latitudes, takes no food and does not grow; its increase in size in temperate latitudes occurs only from May to August.

The spawning season begins in May and continues in some localities till August. A carp weighing four to five pounds, according to Mr. Hessel, yields from 400,000 to 500,000 eggs; the scale carp contains rather more than the other varieties. During the spawning the fish frequently rise to the surface, the female accompanied by two or three males. The female drops the eggs at intervals during a period of some days or weeks in shallow water on aquatic plants. The eggs adhere in lumps to plants, twigs and stones. The hatching period varies from twelve to sixteen days.

According to Hessel the average weight of a carp at three years is from three to three and one half pounds; with abundance of food it will increase more rapidly in weight. The carp continues to add to its circumference till its thirty-fifth year, and in the southern parts of Europe Mr. Hessel has seen individuals weighing forty pounds and measuring three and one half feet in length and two and three fourths feet in circumference.

The carp lives principally on vegetable food, preferably the seeds of water plants such as the water lilies, wild rice and water oats. It will eat lettuce, cabbage, soaked barley, wheat, rice, corn, insects and their larvae, worms and meats of various kinds. It can readily be caught with dough, grains of barley or wheat, worms, maggots, wasp larvae and sometimes with pieces of beef or fish.

Large individuals are found in Prospect Park Lake, Brooklyn, where the species was introduced. The food of the fish in captivity includes hard clams, earthworms, wheat, corn, lettuce and cabbage. Its growth is remarkable; a leather carp has fully doubled its weight in one year.



Quincy

Blue Gill; Blue Sanfish

Blue-Gill; Blue Sunfish (*Lepomis pallidus* Mitchill).

Labrus pallidus MITCHILL, Trans. Lit. & Phil. Soc. N. Y., I, 407, 1815, near New York.

Pomotis incisor CUVIER & VALENCIENNES, Hist. Nat. Poiss., VII, 466, 1831, New Orleans; DEKAY, N. Y. Fauna, Fishes, 33, 1842 (extra limital).

Lepomis pallidus JORDAN & GILBERT, Bull. 16, U. S. Nat. Mus., 479, 1883; MEEK, Ann. N. Y. Ac. Sci., IV, 313, 1888; BEAN, Fishes Penna., 112, pl. 31, fig. 62, 1893; JORDAN & EVERMANN, Bull. 47, U. S. Nat. Mus., 1005, 1896, pl. CLX, fig. 427, 1900.

The propriety of using Mitchill's name *pallidus* for the blue sunfish is extremely doubtful. His decision can be much more readily referred to a species of *Enneacanthus*, and the locality "near New York" does not possess this sunfish among its native species.

The blue sunfish, blue bream, copper-nosed bream or dollardee is a very widely diffused species and varies greatly in size, color and length of the ear-flap. It is found in the Great Lakes and throughout the Mississippi Valley to Mexico. East of the Alleghanies it ranges from New Jersey to Florida. In Pennsylvania it is abundant only in the western part of the State, including Lake Erie. Dr. Abbott has recorded it from the Delaware River. Dr. Meek says that it is found in the Cayuga Lake basin in small numbers with the blue-spotted sunfish, *Apomotis cyanellus*, which he took near Montezuma. It is recorded also from Chautauqua Lake by Dr. Evermann.

The blue sunfish grows to a length of nearly one foot, and individuals weighing nearly two pounds are on record. Adults, however, average eight inches in length, with a weight of less than one pound. The size of the individuals depends on the habitat. In large lakes and streams it grows to a greater size than in small bodies of water. In southern waters it attains to a larger size than in northern waters. It lives in ponds as well as in streams and thrives in warm waters. It is considered equal to the rock bass as a pan fish and can very readily be taken by hook fishing.

In spirits the color is pale brown, the scales with a pale margin; a dark blotch on the hind part of the soft dorsal; a black opercular flap, its width and length about equal, shorter than the eye. The living fish varies with age from light green to dark green. The young have the sides silvery, tinged with purple and with many vertical greenish bands, which are sometimes chain-like. The dark blotch of the soft dorsal is often indistinct in the young. In very old individuals the belly is often coppery red.



Small, yellowish, mottled, with dark spots.

Crawford



Moon-Eye

Moon-Eye (*Hiodon tergisus* LeSueur).

Hiodon tergisus DEKAY, N. Y. Fauna, Fishes, 265, pl. 41, fig. 130; JORDAN & GILBERT, Bull. 16, U. S. Nat. Mus., 260, 1883.

Hiodon tergisus BEAN, Fishes Penna., 57, pl. 25, fig. 44 (named *alosoides*), 1893; JORDAN & EVERMANN, Bull. 47, U. S. Nat. Mus., I, 413, 1896, pl. LXVIII, fig. 180, 1900.

This species is called moon-eye, toothed herring and silver bass. It is found in Canada, the Great Lakes region and the upper part of the Mississippi Valley, being very common in large streams and lakes. It abounds in Lake Erie and the Ohio and is seined in large numbers. DeKay observed the fish in the Alleghany River, N. Y. He recorded it also from Buffalo and Barcelona, on Lake Erie, at which places it is known as moon-eye, shiner and lake herring. He says it is very indifferent food.

This species grows to a length of one foot and, like the other, though a beautiful fish and possessed of excellent game qualities, its flesh is full of small bones. It is a good fish for the aquarium; it will take a minnow or the artificial fly very readily, and the utmost skill is required in its capture. Its food consists of insects, small fishes and crustaceans.

Dr. Richardson describes this fish as a member of the minnow family, which, he says, is known to the Canadians under the name La Quesche. The fish is described as having the back brilliant green, sides and abdomen with a silvery luster. The specimens which were taken in the Richelieu, where it falls into the St. Lawrence, were about nine or ten inches long.



Quoy

MOON-EYE (HIODON TERGISUS)



Rock Bass; Red Eye

Rock Bass; Red-Eye (*Ambloplites rupestris* Rafinesque).

Centrarchus aeneus DEKAY, N. Y. Fauna, Fishes, 27, pl. 2, fig. 4, 1842, Lake Champlain; Great Lakes; streams of Western New York; Hudson River.

Ambloplites rupestris BEAN, Fishes Penna., 105, color pl. 10, 1893; JORDAN & EVERMANN, Bull. 47, U. S. Nat. Mus., 990, 1896, pl. CLVI, figs. 419, A, B, C; MEEK, Ann. N. Y. Ac. Sci., IV, 313, 1898; EUGENE SMITH, Proc. Linn. Soc. N. Y. for 1897, 33, 1898; MEARNs, Bull. Am. Mus. Nat. Hist., X, 319, 1898; BEAN, 52d Ann. Rept. N. Y. State Mus., 104, 1900.

Color olive green with a brassy tinge and much dark mottling; the young are pale or yellowish, irregularly barred and blotched with black; adults with a dark spot at the base of each scale; the spots forming interrupted black stripes; a dark spot on the opercle; soft dorsal, anal and caudal fins with dark mottlings; iris golden overlaid with crimson.

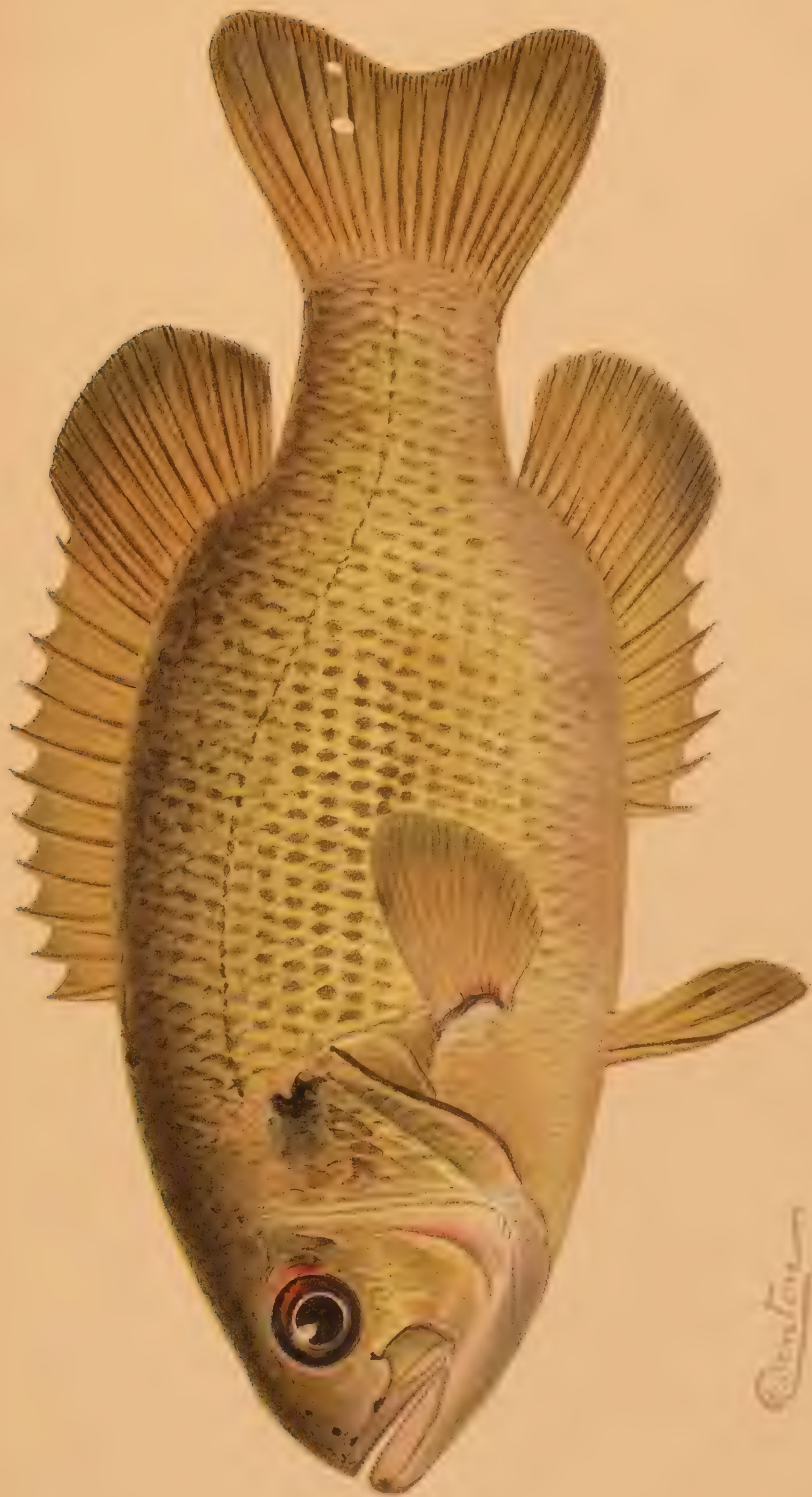
The rock bass is known under a variety of names. Among them are the following: red-eye, red-eyed perch, goggle-eye and lake bass. It is found in Lower Canada, Vermont and throughout the Great Lakes region, West Manitoba, and it is native in Minnesota and Dakota; southward it ranges through the Mississippi Valley to Texas.

Under circumstances favorable as to water and food supply the rock bass grows to a length of fourteen inches and a weight of two pounds. It increases in depth and thickness with age. The largest example we have examined is one of two pounds weight, length fourteen inches, from the James River, Va., taken near Richmond. Dr. William Overton reports that rock bass weighing three and three fourths pounds have been taken in his vicinity at Stony Creek, Va.

In February and March this fish frequents the mouths of small streams, and in summer it seeks shady places under high banks or projecting rocks. The species is gregarious, going in large schools. It thrives where there is not much current and is very well adapted for culture in artificial ponds. It is as common in lakes and ponds as in the streams. Sluggish, pure dark water suits it best.

The fishing season begins in June and lasts till the approach of cold weather. The rock bass feeds on worms, crustaceans and larvae of insects early in the season; later its food consists of minnows and crawfish. The young feed on insects and their larvae. The spawning season is May and June, and gravelly shoals are resorted to for depositing the eggs.

The rock bass bites very freely and is a fair game fish and excellent for the table. It fights vigorously, but its endurance is not great. Suitable baits are white grubs, crickets, grasshoppers, crawfish and small minnows. Common earth-worms are also successfully used.



Quentz

THIRTY-THREE FISHES



Notes on Adirondack Mammals

With Special Reference to the Fur-Bearers.

BY MADISON GRANT.*

THE Adirondacks occupy a somewhat unique position in relation to the faunal areas of North America and, being located at the meeting point of two of these life zones, contain an exceptionally varied group of animals. The earliest account of the zoology of this region is found in the "Description of New Netherlands" by Arnoldus Montanus, 1691, which contains some rather startling information and is worth quoting in full, as follows:

"Lions, whose skins the Indians bring to market, are caught on a high mountain, situated fifteen days journey to the southwest. Here also are many pitch black bears, shy of men, but which when attacked, spring on the hunters; they first stop the wound with a pledget of leaves, and if the hunter, meanwhile take refuge in a tree, climb after and above him, then stick their head between their legs and fall downward. They sleep during winter, lying six weeks on one side and an equal time on the other, sucking their paw. A cripple bush or hollow mountain serves them for a resting place.

"On the borders of Canada animals are now and again seen somewhat resembling a horse; they have cloven hoofs, shaggy manes, a horn right out of the forehead, a tail like that of the wild hog, black eyes, a stags neck and love the gloomiest wilderness; are shy of each other so that the male never feeds with the female except when they associate for the purposes of increase. Then they lay aside their ferocity; as soon as the rutting season is past, they again not only become wild, but even attack their own.

"South of New Netherland are found numerous elks, animals which according to Erasmus Stella constitute a middle class between horses and deer. They appear to deserve the Dutch appellation (eelanden) from elende (misery) because they die of the smallest wound however strong they may otherwise be; also because they are frequently affected with epilepsy. They have broad branching horns, a short tail, a shaggy neck, variable hair, according to the difference of the season, wide and long ears, prominent lips, small teeth, a thick hide, which cannot be easily pierced. The females separate from the males when they have

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shed their horns. Both can be easily tamed. They possess great strength of hoof so as to strike a wolf dead at a blow. The flesh either fresh or salted, is very nutritious, their hoofs cure the falling sickness.

"But no game is more abundant here than deer, which browse everywhere in large herds. When flying before wolves or hunters they oft times head towards streams, betake themselves to the water, where they are taken in great numbers, forwhilst across they get frightened by the echo from the mountains raised by the hunters on the opposite bank; they dare not, consequently, approach land—meanwhile the hunters tie branches together, by which the deer after being chased are sometimes dragged down."*

Bear.

Among the larger animals the bear is, perhaps, in point of popular imagination, the most important animal in the North Woods. The variety found there differs in no respect from the widespread type species (*Ursus americanus*) which extends from Québec to Georgia and westward to the Mississippi. At the borders of this range it is supplanted by closely allied subspecies, into which it merges by imperceptible degrees.

There is no reason whatever why the bear should not be permanently protected in the Adirondacks and allowed to regain something of its former abundance. A step in this direction was made last year (1904) by the enactment of a law prohibiting for three months of the year the killing of this interesting animal. Legislation of this sort is at present a novelty, but protection will ultimately be extended during proper seasons to all animals not known to be noxious. The black bear is an absolutely harmless animal, feeding on berries, nuts and grubs, and only occasionally dining on flesh. In fact there is very little game that the bear is active enough to catch.

As a feature of curiosity to visitors any live bear is worth to the State many times the value of its fur, and if it were protected throughout the year and freed from the annoyance of dogs there is no reason why the North Woods should not resemble the Yellowstone National Park, where not only the black bear but even the once dreaded grizzly now form most interesting exhibits. They can be seen daily in numbers near the large hotels in the Park, feeding on the hotel refuse.

To accomplish such a result, however, it will be necessary to keep dogs out of the woods, and no effort to restore game can be wholly successful unless this is done.

* The first paragraph evidently refers to panther and bear, the second paragraph probably refers to wapiti and possibly to caribou, and the third and fourth paragraphs clearly refer to moose and Virginia deer.—M. G.

In 1892 a bounty of ten dollars was placed on bear by the State of New York, and before the repeal of this law in 1895 bounties were paid on nine hundred and seven bears. During the autumn of 1904 it is estimated that about one hundred and fifty bears were killed in the Adirondacks, eleven of them weighing over three hundred pounds each, and the largest recorded turning the scales at four hundred and twenty-eight pounds.

Puma.

The puma, panther or catamount (*Felis concolor*) is only recently extinct in this State, and is identical with the variety which was found throughout the eastern states north to the St. Lawrence, and through New England eastward to Maine.

The American puma has an immense range, from British Columbia south to Patagonia and the Straits of Magellan, and is now being divided by naturalists into many species and subspecies. It preys chiefly on deer, only turning to smaller game when its accustomed food runs short. In the Yellowstone National Park the puma (known in the West by the grandiloquent name of "mountain lion") has become very destructive to young elk and the wild sheep, and a systematic effort is now being made to destroy it, or at least to reduce its numbers. The puma is a slinking and cowardly beast, and it is hard to account for the bloodcurdling stories about this big cat that once passed current.

It would be interesting to record accurately the latest appearance of this animal in New York, as the most recent authentic occurrence in Pennsylvania was in 1871. Rumors of puma are rife in the Adirondacks, but most panther stories can be traced to the screech owl.

Dr. C. Hart Merriam, writing in 1886, says that he estimates that nearly one hundred pumas have been killed in the Adirondacks since 1860. Since 1871 the State of New York has paid bounties for the killing of ninety-nine of these animals. Gerrit S. Miller, Jr., writing in 1899, says the animal still exists in the wilder portions of the Adirondacks. The last bounty was paid in 1894, for a puma killed in Herkimer County. This may well be the last of these animals in New York.

Bison.

The bison or buffalo (*Bison americanus*) was once found in the State of New York as far east as Syracuse, and may have reached the southwestern limits of the Adirondacks a couple of centuries ago. Stragglers entered the State all through the seventeenth century, but more exact information on this point is greatly needed.

Caribou.

Among the hoofed animals, the caribou (*Rangifer caribou*) occurred formerly in abundance in northern New England, southern Quebec and the Maritime Provinces, but never reached the Adirondacks. Probably the absence of suitable barrens had more to do with this than any climatic cause.

Elk.

The American elk or wapiti (*Cervus canadensis*), on the other hand, was at one time numerous in the Adirondacks, to which it is now very properly being restored. It existed in the western half of the State during the early part of the last century.

The Adirondack elk belonged to the type known as the eastern elk, which is probably now entirely extinct. The difference, however, between it and the well-known elk of the Rocky Mountains would not be great in the eyes of an unscientific observer.

With the permission of Major W. Austin Wadsworth, the former President of the Forest, Fish and Game Commission of this State, a photograph is published herewith, showing antlers of several elk killed in the Genesee Valley about 1843. There is a definite record of an elk killed at Bolivar, in Allegany County, New York, in 1834. The celebrated Flag Swamp elk was killed in Elk County, Pennsylvania, in 1867, and was probably the last of this species in the Allegheny Mountains, unless some stragglers lingered on later in West Virginia.

The late Eli Parker, captain in the United States Regular Army, and a full-blooded Seneca Indian, who recently died at an advanced age, told the writer that, as a boy, he remembered clearly hearing the old men of his tribe, then located in western New York, tell of their annual hunts to the south—Pennsylvania—for elk, and to the east—Adirondacks—for moose.

In 1901 an effort was made to restore this animal to the Adirondacks by liberating twenty-two elk, and in 1903 a large herd was liberated in the woods through the liberality of the late William C. Whitney. The attempt has been successful, and it is estimated that there are to-day fully two hundred of these splendid creatures at large in the North Woods. If from time to time some new stock is introduced—a few bulls would be sufficient—the elk will certainly be reestablished.

Moose.

The moose (*Alces americanus*) is, of course, well known to have existed in the Adirondacks as late as the early '60's and was specifically identical with the type

still inhabiting Quebec and Maine. A photograph of the only set of Adirondack moose antlers of which the writer has knowledge is reproduced herewith by permission of the American Museum of Natural History, where they are now on exhibition. These antlers were the property of the late Hamilton Fish, and belonged to a moose killed about 1855 in this State, one of the last of this species in the Adirondacks.

The moose can easily be restored to the Adirondacks if a sufficient number—not less than one hundred individuals—be liberated under proper precautions. Sooner or later this will be done, and a very successful beginning has been made through the energy of Mr. Harry V. Radford and the Game Commission of this State.

Deer.

The deer of the Adirondacks (*Odocoileus virginianus borealis*) is probably as abundant to-day as at any former period, and bids fair to permanently adapt itself to the quasi-civilization which now prevails in the North Woods. It belongs to the northern variety of the Virginia deer, which embraces all the members of the genus from Pennsylvania north and east. The true type of Virginia deer (*Odocoileus virginianus*) is found to the south of this subspecies.

It is a satisfaction to be able to note the entire success of the law prohibiting the hounding of deer, and also the recent change in public sentiment regarding this unsportsmanlike mode of hunting, in spite of the fact that the measure, when first proposed, met with violent opposition from the guides and innkeepers. New York was one of the last States to prohibit the use of hunting dogs, but the protection of game is everywhere becoming increasingly popular.

About two thousand deer are killed annually in the Adirondacks, and that the species is not deteriorating is proved by the records of weight. In 1904 not less than thirty deer weighed, when dressed, above two hundred and up to two hundred and fifty pounds, certainly full size for the deer of this region.

Among the smaller carnivora in the Adirondacks we find representatives of four families.

Raccoon.

The first of these, the Procyonidae, is represented in the Adirondacks by the raccoon, which is here found close to the northern limit of its range. The raccoon family is widely distributed throughout South and Central America and northward to the fiords of British Columbia. In the extreme northeast it is found on the borders of the Adirondacks, but seldom enters the more thickly wooded portions.

It is probable that in the Adirondacks the raccoon will flourish, as it prefers clearings and open groves to the denser forest. In this respect the raccoon is in sharp contrast with the marten and fisher, both of which retire before the approach of civilization deeper and deeper into the woods.

The wolf and red fox are the representatives of the second family, the Canidae, in the Adirondacks.

Wolf.

The Appalachian gray or timber wolf (*Canis mexicanus nubilus*) was originally very abundant in the Adirondacks and remained so down to 1871. That year a bounty was placed on wolf scalps, and, curiously enough, this animal became scarce. The disappearance of wolves at that time has never been satisfactorily explained, as from that date to 1897 only ninety-five bounties were paid. There were said to be, in the early days, a gray and a black variety, but it is too late now to determine this question.

Vanderdonck, writing in 1645 of the region of the lower Hudson River, says that on account of the ravages of wolves it was almost impossible to keep sheep in the colony. These animals find their chief food supply among the deer, and it is quite possible that the disappearance of wolves noted in 1871 was due to a decrease in number of the latter, as hide hunters were very active in those days. It is interesting to note the persistence of wolves in Europe, where a considerable number are still annually killed in Germany and France, as contrasted with their rapid decline nearly everywhere in America. The universal habit of carrying firearms and the use of poison in this country probably account for the difference.

That the wolf in the Adirondacks is not altogether extinct is evidenced by the bounty records, which show that six wolves were killed in each of the years 1895, 1896 and 1897, although in the six years preceding no bounties were paid.

Fox.

The Adirondack red fox is indistinguishable from the type species (*Vulpes fulvus*), which extends from Minnesota to Nova Scotia and from Quebec and Maine to North Carolina. This fox is subject to color variations, culminating in the almost priceless pelt of the black fox, and in that of the valuable silver or cross fox. These variations were once supposed to represent distinct species, but inasmuch as the animals showing them have been found in the same litter, the question is no longer open to dispute. The black and silver foxes are scarce in all countries, but tend to increase in numbers in the north. They appear to be particularly rare in the Adirondacks.

It is a well-known fact that the numbers of the fox, as of the lynx, fluctuate greatly. From 1853 to 1877, inclusive, the Hudson Bay Company sold in London 260,775 red, 59,650 cross and 20,100 silver and black foxes. This will afford some idea of the proportionate number of the several colors.

Gray Fox.

The gray fox (*Urocyon cinereoargenteus*) does not reach the Adirondacks, in fact, barely enters southern New York.

Opossum.

The Virginia opossum (*Didelphis virginiana*) likewise occurs in the lower counties of the State, but does not reach the North Woods.

In the Adirondacks the only two members of the Felidae or cat family, in addition to the puma mentioned above, are the two lynxes.

Canada Lynx.

The Canada lynx (*Lynx canadensis*) is of wide distribution, and formerly extended south into Pennsylvania, along the line of the Alleghenies. It is, however, exceedingly rare, and in recent years has been almost unknown in the Adirondacks, although probably not altogether extinct.

This animal, known to the Canadians as the loup cervier, which in Maine is corrupted to "lucivee," is large, powerful and savage, and is closely related to the European lynx. It is a rabbit-killer by profession, and many of the stories which are referred to the puma should be properly credited to this animal.

The Canada lynx apparently culminates, as far as the northeast is concerned, both in point of size and in numbers, in Nova Scotia and Newfoundland. In the latter colony it has taken to preying on young caribou, and has greatly increased in numbers, apparently occupying, in the economy of nature, the place of the wolf, which has almost disappeared.

Perhaps the most interesting fact about the Canada lynx is its periodic increase and decrease in numbers, which occur every decade. The records of the Hudson Bay Company indicate that the catch of Canada lynx for each of the three seasons when they are least numerous falls as low as four to five thousand skins for the whole territory covered by the company's posts. In the fourth year the catch is twice as large, and the fifth year will often more than double the catch of the preceding year. The sixth year's catch doubles that of the fifth, while

the seventh year would almost invariably witness the maximum trade in lynx skins. The catch of the eighth year would still be good, while that of the ninth and tenth years would show a startling decline in the numbers of lynx taken. In twenty-five years, from 1853 to 1877, the Hudson Bay Company sold, in London, more than half a million lynx skins, the minimum number being 4,488 in 1863 and the maximum number 76,556 in 1868.

Bay Lynx.

The bay lynx (*Lynx rufus*), called the wild cat or bob cat, is widely distributed from Maine to Georgia, and westward to the Mississippi Valley. It is widespread and far from extinct. Several fine specimens have been taken within recent years in Tuxedo Park, near New York. This lynx is rather smaller than the preceding species, and is the chat cervier of the Canadians. They were so numerous in the early days that in 1712 an act was passed offering a large bounty for wild cats in Suffolk County, now the eastern end of Long Island. It may be stated in passing that there are no true long-tailed cats in America north and east of Texas, except the puma, and all stories of "wild cats" may be safely referred to this species.

Reference need only be made to three rodents, as the remaining Adirondack species of this order are of small size and are far more numerous than all the other mammals taken together.

Woodchuck.

The northeastern woodchuck, ground hog, whistler or siffleur of the Canadians (*Arctomys monax canadensis*) has a wide distribution, covering the region from Hudson Bay and Newfoundland westward to the great plains, but is scarce except in the cultivated portions of the Adirondacks.

There are a number of ill-defined subspecies, but the Adirondack variety belongs to the dark race of the Hudson Bay region rather than to the Maryland form. Its habits are too well known to call for much notice.

Beaver.

In former days the most important of the Adirondack fur-bearing animals was the beaver (*Castor canadensis*), which presents no clearly defined variation in type throughout northeastern America, although the forms in the southern states, in Mexico and on the Pacific Coast are assigned to subspecific rank. Its

American distribution is from the Rio Grande in the southwest, northward, generally to the limit of tree growth. It is also found along the Colorado River near its mouth.

The American beaver is closely related to its European congener, which still lives in some of the more remote rivers of eastern Europe. They are found as far south and east as the Caucasus Mountains. We have little information about their occurrence in Siberia beyond the fact that they are found there.

It is almost impossible to estimate the part this animal played in the early history of America. Its pelt was for a long time a standard of value, and so remains to-day in certain districts in the far north. In the unbroken forest which extended from Hudson Bay to Florida, the first clearings of the settlers were made by breaking out the beaver dams and draining their ponds. The dry mud flats thus exposed yielded meadow hay the second year, and could soon after be tilled. Thus the cabins of the first settlers came to be located along streams and rivers out of supporting touch with one another when the Indian attacks came.

The abundance of beaver is subject to fluctuation, and the animals will sometimes almost disappear from an entire district. They can readily be restored to the Adirondacks, and if left undisturbed will rapidly multiply. Several pairs of beaver have been recently liberated in the North Woods, and if this good beginning is followed up, these interesting animals and their works will again be seen along our streams and lakes. Beaver had become very scarce in the Adirondacks by the beginning of the nineteenth century, but the war of 1812 put a check to hunting and trapping and allowed a great increase in the number of all the furbearers. As soon as hunting was resumed after the war, beaver again disappeared, and by 1840 were very rare. A few still linger on in the North Woods.

When too much harassed, this animal ceases to build dams and houses, and becomes what is known as "bank beaver." The writer has in recent years found bank beaver in the waters of Maine and the Maritime Provinces, and such few individuals of the original stock as have survived in the Adirondacks have adopted these habits. An ordinary beaver pond usually contains only one family, but the deserted cabins of preceding years often cause an exaggerated idea of the number of beaver in the pond.

Some idea of the former abundance of beaver and their proportion to otter is furnished by the statistics of the ten years following 1624, which show that 80,183 beaver skins and 7,247 otter skins were exported in those years from New Amsterdam. In the twenty-five years from 1853 to 1877 the Hudson Bay Company sold in London nearly three million beaver skins. In these later days, however, the annual catch is rapidly declining.

The attempt to establish beaver in the New York Zoological Park in New York City resulted in the pond assigned to them being taken possession of by three large individuals, who promptly destroy other beaver as fast as introduced.

When cutting wood on the shore the beaver is almost helpless, and is captured by many animals, the lynx being probably its most dangerous enemy. The otter also is generally credited with killing it, but this can scarcely be true, since the beaver could be easily exterminated by this powerful and agile animal, which could enter its houses from below water. The wolverine is sometimes called by the Indians the beaver-killer, and it is supposed to tear open and destroy beaver houses, but beaver could not be caught in this way, as all the cabins have exits under water and many beaver ponds have deep tunnels or holes in the bank, for refuge in case the house is destroyed or the water lowered by the destruction of the dam.

Muskrat.

The muskrat or musquash (*Fiber zibethicus*) is of almost universal distribution in North America, extending from the delta of the Mackenzie River as far south as Louisiana. It thrives so well in civilization as to be a nuisance in the New York Zoological Park. In Prospect Park Lake, Brooklyn, a trapper is specially employed to keep these animals in check, and the catch in 1903 amounted to over 2,000, and in 1904 to 1,230. The fur of the muskrat is becoming commercially important, and the Hudson Bay Company sold in London in 1901 two million skins of this animal. This is the largest sale on record.

The muskrat is not exclusively a vegetable eater, but sometimes indulges in a meal of flesh. It is suspected of occasionally feeding on turtles, and is known to be fond of fresh-water mussels. It is, on the whole, an interesting animal, harmless, except in parks, and in the Adirondacks well deserves toleration.

Porcupine.

The only remaining rodent that we need to consider is the Canadian porcupine or quill pig (*Erethizon dorsatum*). Its distribution is from the northern limit of timber south into Pennsylvania. The porcupines originated in South America and worked north from that continent at an early date, geologically speaking, and have become thoroughly adjusted to boreal conditions.

This animal is numerous in the Adirondacks, but the natives there feel a bitter antipathy toward this curious and harmless creature. This hatred is probably a relic of the old days when dogs were used for hunting deer, and when many fine hounds were destroyed or seriously injured by the quills of porcupines. In Nova

Scotia and eastern Canada, on the other hand, it is considered almost a crime to wantonly destroy a porcupine, as it is the only animal which a lost and starving man can kill with a club.

The quills of the porcupine are exceedingly penetrating, and when once inserted in an animal will work in between the skin and flesh, and sometimes through the sinews to the uttermost parts of its anatomy.

The puma and fisher are both credited with a fondness for porcupine meat, and are said to pay a high price for it. The writer, however, does not believe that either of them, unless starving, would attack this animal.

The porcupine is a bark-eater with a special fondness for the hemlock, but will make a meal of the bark of any of the conifers. In the Bitter Root Mountains many of the spruces were found deeply scarred at the base, where the bark had been stripped half way round the tree. This cutting was generally credited to the porcupine, which is also very destructive around lumber camps, as it gnaws away the floor logs to get at the salt left from the brine of the pork barrels. It is one of the few creatures seen by the average tourist or visitor in the North Woods, and the present foolish persecution of it should be stopped by law.

The last and perhaps most important family of the fur-bearing animals in the Adirondacks is the Mustelidae. This group includes a large and varied series of animals, ranging in size from the pigmy weasel to the otter and wolverine.

Least Weasel.

The smallest member of the family is the least weasel (*Putorius allegheniensis*), a diminutive and ferocious animal. Like most of the small carnivores it feeds on mice, which it hunts tirelessly and with a relentless persistency which is almost without parallel in the animal kingdom.

Weasel.

The true weasel or American ermine (*Putorius noveboracensis*), so called from its fur turning white in the winter, is a large edition of the last species. It, too, preys on mice and also on rats, grouse and squirrels. Its lack of agility, as in the case of the least weasel, is more than compensated by the extraordinary pertinacity with which it trails down its victims. This relentless chase ultimately wears out the most active rat, and in the end the unfortunate quarry is so completely paralyzed by fear that it almost invites the death stroke. The attack is nearly always made at the base of the skull, where the sharp teeth of the weasel tear open the brain case with a single stroke. In 1903, 33,883 weasel or ermine skins were sold by the Hudson Bay Company in London. This was far above the normal catch

Skunk.

The skunk (*Mephitis mephitis putida*) is widely distributed throughout North America. In Texas and the southwestern states the fur of an allied species known as the hydrophobia skunk, characterized by a narrow white stripe down the back, has recently become quite fashionable. The fur of a common skunk is known among furriers as "Alaska sable."

All the Mustelidae are provided with an offensive odor, but it is only in the skunk that this scent is sufficiently developed to be protective. When deprived by a simple operation of its power of offense the skunk can be tamed and made a most attractive and interesting pet, although it will probably not become popular in that capacity. The strongly marked coloring of its coat serves as certain identification and consequently is a protection against attack. The skunk is one of the few animals which appear indifferent to the presence of man, and it will scarcely take trouble to get out of his road. Fortunately it is nocturnal in its habits, or it would more frequently be seen.

The reputation of the skunk is far worse than it deserves to be. This animal is of value to the husbandman for the thoroughness with which it destroys mice and insects, although it occasionally raids hen-roosts. Like the porcupine, the skunk hibernates only during the severest portion of the winter.

Mink.

The Adirondack mink (*Putorius vison*) belongs to the type subspecies which extends throughout Canada westward to the Rocky Mountains, north to the Arctic Ocean, and southward into the Adirondacks. It is closely related to the European and Siberian mink.

DeKay, in his natural history, suggests that there are two varieties in the North Woods, one the mountain mink, small and black, and the other a water mink, large and of a chestnut-red color. We have had nothing in recent times to confirm the existence of these two types.

The mink is a restless animal, making regular trips along fixed routes on the shores of streams or lakes. It is a fierce little beast, feeding chiefly on fish, which it catches with great dexterity. It is fond of crayfish, and is destructive to muskrats. Chicken roosts are often invaded by this small marauder, and many a fisherman who has left his trout on the bank has been robbed by this animal.

The mink has been the victim of much persecution on account of its beautiful fur, but if given half a chance would easily recover its original numbers in the

Adirondacks. So persistent is it that several specimens are killed every year in the New York Zoological Park. While subject to fluctuation in numbers, like other fur-bearing animals, the mink holds its own fairly well.

Marten.

After the beaver, the most important fur-bearing animal in the Adirondacks is the Canada pine marten or American sable (*Mustela americana*), which is closely related to the European pine marten and Siberian sable, although its coat does not compare in beauty with the rich dark fur of the latter animal. The specimens from the Adirondacks are much lighter in color than the furs from farther north. In British Columbia large black skins are relatively common.

The marten is a tireless traveler and hunts in the daytime for its quarry, chiefly red squirrels, which it runs down and captures by superior agility and strength. The writer found marten quite numerous around Little Tupper Lake as late as 1891, but it has been trapped almost to extinction since that time.

The enormous rise in the value of the skins of this animal has nearly resulted in its extermination. It is usually taken by traps set on a line running sometimes for miles, with from six to ten traps to the mile. A drag of meat is drawn from one trap to another, and in this way an entire district can be covered so that sooner or later nearly every marten can be caught. In the winter of 1901 some enterprising trappers in the Bitter Root Mountains in Idaho started a marten farm to take advantage of the increased price of fur. After a number of these animals had been captured they were discovered to be all males. Apparently it was the breeding season and the males alone were cruising about while the females were hidden away.

There are known to be seasons of abundance and of scarcity of marten. Epidemics seem to occur every few years and greatly reduce the numbers of certain fur-bearing animals. The most interesting case of this periodic plague is the mysterious disease which occurs at regular intervals in the Canadian northwest and almost exterminates the rabbits throughout an immense extent of country. For a year or two the species appears to have entirely perished. The rabbits then rapidly increase and in two or three years the countryside swarms with them until the pest again appears and the cycle is repeated. The lynx, which depends on the rabbit for its food supply, suffers and starves during the years of scarcity, and greatly decreases in numbers. Many of the survivors migrate long distances. When the rabbits regain their abundance the lynx follow suit and multiply. Nothing could better demonstrate the balance of nature and the interdependence of animal life.

Fisher.

The fisher, black cat or pekan of the Canadians (*Mustela pennantii*) is one of the most important of the weasels. It is a large, powerful black marten and originally was thinly distributed from the Atlantic coast to the Cascade Mountains close to the Pacific Coast, where it was supplanted by a closely allied species. It extended formerly from timber line in the north well into the Alleghenies of Pennsylvania. It would be interesting to know whether this animal was ever abundant; but, if so, it felt at a very early period the effect of encroaching civilization. In New York it was confined to the Adirondacks as early as 1842.

In spite of its relatively large size it is extremely agile and active, and preys largely on pine marten, which it captures in open chase. It is popularly supposed to live on porcupines, but it is probable that the legend arose from the fact that in the leg joints of one of the earliest specimens to find its way into the hands of the naturalists were found embedded the quills of that animal. When pressed by hunger the fisher undoubtedly will attack the porcupine, but under ordinary circumstances it could get its food without such extreme danger and discomfort.

The fisher is a sworn foe to the trapper, and will follow up and destroy his line of traps with great persistence. In this last respect it has been remarked that the fisher "is less objectionable than the wolverine, in that it leaves the traps where it finds them, while the other blackleg lugs them off and hides them."

Fishers are rare throughout the north, and are seldom seen in captivity, although at present (June, 1905) several specimens are on exhibition in the National Zoological Park, Washington, D. C., and one in the New York Zoological Park. It is doubtful whether this animal can be restored to the Adirondacks, but it would do no harm to protect the few that probably linger on in the remoter parts of the wilderness.

The Hudson Bay Company sold in London, in 1902, 3,679, and in 1903, 3,223 skins of this animal.

Wolverine.

The last of the true weasels is the wolverine (*Gulo luscus*), improperly called the glutton. This is the carcajou of the French Canadians, and is called by the Ojibway Indians the "quingagee," or tough customer. The American type is so closely related to the European form that it has not yet been described as a separate species, although it would undoubtedly prove to be such on close investigation.

The wolverine was originally supposed to be one of the bears, but further investigation proved it to be nothing more than a gigantic weasel. It is one of

rarest and least known of North American animals, and about the only place where specimens can be obtained with any certainty is in the barren grounds of northern Canada and Alaska. The specimens from the extreme northwest have recently been assigned to a new species. This species formerly extended south to Pennsylvania and Colorado, and reached from the Atlantic to the Pacific Oceans. It probably occurred in the Adirondacks, but was never abundant there.

Through the north country this animal has an evil reputation for robbing food caches. No matter how deeply buried under stones or logs may be the food supply stored up by the hunters for their return trip, if once found by the wolverine the cache is torn apart and scattered. Things which cannot be eaten are destroyed, and many articles actually are carried off and hidden.

Trappers have been driven out of a district by the persistence with which this animal followed up and destroyed not only the traps and bait, but marten caught in them. The restoration of the wolverine to the Adirondacks need not be considered, as, aside from its impossibility, the popularity of the animal with campers would be more than doubtful.

In the twenty-five years from 1853 to 1877, inclusive, the Hudson Bay Company sold in London 32,975 skins of the wolverine. In 1902 and 1903, only 635 and 695 skins, respectively, were sold. Most of them came from the Mackenzie basin.

Otter.

The largest of the Mustelidae in the Adirondacks is the otter (*Lutra canadensis*). The American otter is found throughout eastern America north of the Carolinas, and is closely related to the European species. The genus itself is one of the most widely distributed of the Mustelines, extending even into South America, where in the waters of the Amazon is found a giant otter.

The otter is almost as well adapted to aquatic life as the seals, and in the distantly related sea otter of the North Pacific the resemblance to the seals becomes still more striking. Of course this resemblance does not indicate relationship with the seals, but is merely in response to similar environment, called by zoologists parallelism. Like the seal, the otter is an expert fisher, and by its skill in swimming can capture even the swift trout in shallow streams. It is also much given to feeding on ducks, which it catches by swimming under water and seizing them by the legs.

The otter is scarcely ever at rest, and in the early days of the Adirondacks it was not an uncommon sight to see one of these graceful animals thrust his head above the surface of a pond or lake, turning it round until the resemblance to a bent and gloved hand thrust above the surface of the water was most striking.

The trapping of otter in this State is now prohibited until 1906. This close season should be extended for a further period of ten years at least if the otter is to regain its former abundance.

This animal is so keen in avoiding traps that the difficulties of capturing it would be much greater were it not for its habit of building slides. These slides are used simply for amusement, but a trap placed at the end of one of them has been the undoing of many a playful otter.

In the twenty-five years preceding 1878, 318,140 otter skins were sold in London by the Hudson Bay Company.

Most of the animals described above could and should be restored to their native haunts in the Adirondacks. If alive, and brightening the somber North Woods with their presence, they would be worth far more to the State than the mere value of their skins.

The time is rapidly approaching in this country when game refuges will be recognized as the only means of protecting our American fauna. Some section of the Adirondacks embracing forest, stream and lake should be set aside for a breeding ground for all the native animals, where they should be left absolutely undisturbed, and no one allowed to set a trap, light a fire or enter with a gun or dog; and above all, no foreign species should be introduced.

A few years after the establishment of such a sanctuary in the Adirondacks the excess of animal population would supply the adjoining country, and the interest and value of the wilderness would be greatly enhanced. It is only a question of time when something of this sort will be done in the North Woods, and the privilege of carrying a gun at all times and slaughtering everything in sight will be abridged. When that day comes, the old order of things in America will have passed and the conditions which have long prevailed in portions of Europe will spread over the country.

The writer desires to acknowledge the skill and patience shown by Mr. Elwin R. Sanborn in photographing the animals of the New York Zoological Park.



BLACK BEARS IN YELLOWSTONE NATIONAL PARK.





BEARS IN YELLOWSTONE NATIONAL PARK. TOURISTS LOOKING ON.



PUMA IN THE NEW YORK ZOOLOGICAL PARK.





PUMA IN THE NEW YORK ZOOLOGICAL PARK.





ANTLERS OF ONE OF THE LAST MOOSE KILLED
IN THE ADIRONDACKS.

DONATED BY THE HEIRS OF THE LATE HAMILTON FISH TO THE
AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY,
AND ON EXHIBITION THERE.



ANTLERS OF ELK KILLED IN GENESEE VALLEY ABOUT 1845.

PROPERTY OF MAJOR W. AUSTIN WADSWORTH, GENESEO, N. Y. LAST ELK KNOWN TO OCCUR IN THE STATE OF
NEW YORK.





RACCOON PHOTOGRAPHED BY FLASHLIGHT BY HON. GEORGE SHIRAS, 3D.





RACCOON IN THE NEW YORK ZOOLOGICAL PARK.



TIMBER WOLF IN THE NEW YORK ZOOLOGICAL PARK.





GRAY FOXES IN THE NEW YORK ZOOLOGICAL PARK.





RED FOX IN THE NEW YORK ZOOLOGICAL PARK.



OPOSSUM IN THE NEW YORK ZOOLOGICAL PARK.





CANADA LYNX IN THE NEW YORK ZOOLOGICAL PARK.





CANADA LYNX IN THE NEW YORK ZOOLOGICAL PARK.



BAY LYNX IN THE NEW YORK ZOOLOGICAL PARK.





BEAVER IN THE NEW YORK ZOOLOGICAL PARK.





WOODCHUCK IN THE NEW YORK ZOOLOGICAL PARK.



MARTEN IN STEEL TRAP.

COURTESY OF JOHN M. PHILLIPS.





MUSKRAT FROM ROCKY MOUNTAINS.

COURTESY OF HON. GEORGE SHIRAS, 3D.





PORCUPINE IN THE NEW YORK ZOOLOGICAL PARK.





ALBINO PORCUPINE TAKEN BY FLASHLIGHT BY HON. GEORGE SHIRAS, 3D.





SKUNK IN THE NEW YORK ZOOLOGICAL PARK.





MINK IN THE NEW YORK ZOOLOGICAL PARK.





MARTEN IN PHILADELPHIA ZOOLOGICAL GARDEN.

COURTESY OF E. T. SETON.





FISHER IN NATIONAL ZOOLOGICAL PARK, WASHINGTON, D. C.

COURTESY OF DR. FRANK BAKER.





FISHER IN NATIONAL ZOOLOGICAL PARK, WASHINGTON, D. C.

COURTESY OF DR. FRANK BAKER.



WOLVERINE.

COURTESY OF J. S. EDWARDS.





WEASEL.

FROM W. H. WRIGHT, SPOKANE, WASHINGTON.



WOLVERINE FROM BRITISH COLUMBIA.

IN THE NEW YORK ZOOLOGICAL PARK.





WOLVERINE KILLED BY ROBERT WALCOTT IN
LABRADOR.

COURTESY OF WILLIAM B. CABOT.





ELWIN R. SANBORN, PHOTO.



ELWIN R. SANBORN, PHOTO.

WEASEL OR AMERICAN ERMINE IN WHITE WINTER COAT.

FROM THE NEW YORK ZOOLOGICAL PARK.





OTTER IN THE NEW YORK ZOOLOGICAL PARK.



The Squirrels and Other Rodents of the Adirondacks

BY FREDERICK C. PAULMIER.*

EXCEPT for the comparatively few domesticated animals, which include the horses and cattle, belonging to the Ungulata, or grazing animals, and the carnivorous cats and dogs, by far the greater number of those which come into economic relations with man belong to the order Rodentia, or the gnawing mammals. In distinction, however, from the domesticated forms, which are used as food, or as beasts of burden, or as companions, the Rodentia are nearly all injurious, only in a very limited degree serving man as food or furnishing him with useful skins. True it is that some forms are hunted, and noted apologists for this form of sport are not wanting. Still, when the balance is struck, it is found that the misdeeds of some of them many times counterbalance what value the rest of them possess.

Scientifically speaking, the Rodentia may be described as mammals in which the number of teeth is reduced, the back teeth, or molars and premolars, varying in number from four to six on each half of the jaw, and with the eye teeth, or canine teeth, always wanting. It is in the front, or incisor teeth, however, that the greatest modifications occur, for they are specially adapted for gnawing, and to this end have only the front edge composed of hard enamel, while the back part is composed of softer dentine, which, wearing away more rapidly than the harder enamel, under the constant use that the teeth are put to, leaves a sharp, chisel-like edge to the latter. To compensate for this wear, which would soon bring the teeth down to the gums, these teeth, unlike other mammal teeth, grow continuously at the base, throughout the life of the animal, at a rate which just compensates for the loss at the tip. Should, however, as sometimes happens, one of these front teeth become broken or lost so that its fellow in the opposite jaw has nothing to wear against, and by that be kept short, the latter grows to an inordinate length, usually curving around into the mouth of the animal and killing it, either by preventing it taking food or by growing through the roof of the mouth into the brain.

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Another point characteristic of the rodent's mouth is the peculiar manner of growth of the hairy integument, which is continued inward behind the incisors, and apparently prevents the wood or other hard substance the animal is gnawing, and which is not intended for food, from getting into his throat.

The rodents are nearly all of comparatively small size, but make up for this in their great numbers, both of species, of which there are over 900 known in the world, and of individuals, which are far more plentiful than of any other group. They are all herbivorous, only occasionally taking to animal food, and they obtain their food by gnawing. They are found in all sorts of habitats; some, like the squirrels, being arboreal, and being even provided with a parachute for taking long leaps from tree to tree; others, like the hares, are cursorial; the kangaroo mice are agile jumpers, the mole rats are burrowers and the beavers and water voles aquatic.

Then, too, the group is the most cosmopolitan of any, no country being without some representative of it. This, however, is partly due to the agency of man, for wherever he goes the domestic rats and mice follow him.

In New York State the rodent population numbers twenty-eight species, and of these the largest, the beaver, is now extinct. Attempts, however, are now being made to reintroduce him into the Adirondacks, two small colonies having recently been placed in different parts. It is to be hoped that this experiment will prove to be successful, for the beaver is the most interesting of the rodents and everyone knows of his tree cutting and dam building operations. Then, too, he is of considerable interest, for his was one of the most valuable furs found in the New World, and was the object of eager pursuit by the early settlers. Many were the quarrels which arose, not only between individuals, but even between the colonies, in regard to the proper delimitation of the trapping grounds. So numerous was he in those early days that, according to Pennant, 54,670 skins were sold in a single sale of the Hudson Bay Company. In fact, so important was he recognized to be to the commonwealth, that the provincial seal of New Netherland was a beaver on a shield.

The muskrat is another form which was hunted for its fur, though that is of greatly inferior value to that of the beaver. Still, Richardson, writing in 1829, says that between four and five hundred thousand skins were annually imported into Great Britain from North America. At the present time it is mainly the object of pursuit of the small boy, for it is probably the most easily trapped of our mammals, besides being quite common in inhabited districts. They prefer swamps and sluggish streams, and in the Adirondacks, in such places, their irregular mound-like winter huts, composed of aquatic plants and mud, are often to be



PORCUPINE (ERETHIZON DORSATUS)



found. Besides these, they have burrows in the shores of streams, and where there are dams they sometimes do considerable damage by undermining their banks.

The woodchuck, which is about as uninteresting an animal as there is, occurs rarely in the Adirondack woods, but is much more at home in the cultivated areas surrounding them. Here, in the meadows or hillsides, where there is a good supply of grass or clover, he digs his burrows, which often prove a nuisance to the farmer with his horses.

Still another large rodent, belonging to another family, is found in the Adirondacks. This is the Canada porcupine. This curious beast, on account of its formidable armature of spines, has but few enemies, of which the fisher and the panther were the chief, and since these have become rare or extinct, the porcupine has probably increased in numbers. Fear of man, too, is apparently lacking, or more probably he has not sufficient intelligence to appreciate what man can do, for he often wanders into camps and explores the surroundings in search of salt in the most familiar way. A specimen the writer met this summer had to be assisted with the boot before he would move from the trail. In spite of his commonness he is not often seen, as he spends most of his time high in the trees, where he may be mistaken for a bunch of twigs or a crow's nest. He also possesses, as a permanent domicile, a den, usually among the rocks.

Ranking next in size of the rodents, we find the rabbits, or hares, as they should more properly be called, the domesticated white rabbit, which is an English form, being the only one to which the term properly applies. Of these there are two species found in the Adirondacks, the larger of which is known as the varying hare or white hare. This species is divided into two subspecies, of which one is called the northern varying hare, and is distinguished by the fact that, while, like all of our other mammals, he has two coats during the year, a summer and a winter one, his winter coat is a pure white, which, matching the snow, enables him the more easily to escape his enemies. This change is common in many of the northern mammals, and, of the New York forms, the ermine and the least weasel adopt it. This subspecies is found in the forests in all parts of the Adirondacks and Catskills above 1,500 feet.

The other subspecies, the southern varying hare, which replaces the former along the southern and eastern borders, lives in a region where the snow is not so deep or so abundant during the winter, and as during its absence a white coat would render him too conspicuous, he has adopted a mottled, lighter brown. This form, according to Stone, is not holding its own very well, but has been replaced to a great extent by the gray rabbit or cottontail, which is a smaller and even more defenceless species than the varying hare. The cottontail occasionally

does some damage in the orchard and garden, but his principal economic value is in furnishing sport for the man with the gun.

We come now to the squirrels, of which there are five distinct species found within the limits of New York State. They belong to the family Sciuridae, and are distinguished from the other rodents by their bushy tails and by several anatomical points, of which an important one is the nonfusion of the lower leg bones, which takes place in the mice and their allies, and which allows a much freer use of their legs in climbing trees, a habitat to which most of them are partial. The five species are the red squirrel, the gray squirrel, the chipmunk and two flying squirrels, the common southern form and the northern flying squirrel.

To the wanderer in the Adirondack forests the red squirrel is probably the commonest mammal seen. Originally described as *Sciurus hudsonicus* by Erxleben, in the light of more recent and careful research it has been found necessary to divide the species into two subspecies, which have been described by Bangs as the northern or Canadian red squirrel, *S. h. gymnicus*, and the southern, *S. h. loquax*. Both subspecies are found in the State, the southern extending over the greater portion of it except the Adirondacks, where it is replaced by the northern form. The difference between the two is but slight, consisting mainly in the deeper, redder color of the northern form, and where the two meet each other, individuals intermediate between the two forms occur, and it is impossible to say to which variety they belong. As there is no difference in the behavior or habits of the two forms almost anything that may be said about the one applies to the other.

If there is any one animal to which dry, scientific terminology does not fit, it would seem to be the red squirrel, for a merrier, happy-go-lucky scamp does not appear to exist. Even in the deepest part of the Adirondacks, in the ever-green forests, where the deep shade would appear to cast a gloom over the spirits of almost anything, the wanderer will find these cheerful animals chasing through the tree tops, or sitting on a limb, chattering and scolding at him in a most impudent manner.

Dr. Clinton Hart Merriam, to whom we are indebted for a most interesting account of the mammals of the Adirondacks, and whose paper has been frequently drawn on in the preparation of this, sums up the character of the red squirrel in a most happy manner. He says: "The Chickaree combines qualities so wholly at variance, so unique, so incomprehensible, and so characteristic withal, that one scarcely knows in what light to regard him. His inquisitiveness, audacity, inordinate assurance, and exasperating insolence, together with his insatiable love of mischief and shameless disregard of all the ordinary customs and civilities of life, would lead one to suppose that he was little entitled to respect;



RED SQUIRREL (SCIURUS HUDSONICUS GYMNICUS)



and yet his intelligence, his untiring perseverance, and genuine industry, the cunning cleverness displayed in many of his actions and the irresistible humor with which he does everything, command for him a certain degree of admiration. He is arrogant, impetuous, and conceited to an extreme degree, his confidence in his own superior capabilities not infrequently costing him his life. In fact, these contradictions in character and idiosyncrasies in disposition render him a psychological problem of no easy solution."

As mentioned above, he is found in all parts of the Adirondacks and at all times. From the earliest morning till sunset he is always abroad and busy, and even after dark, especially on moonlight nights, he may sometimes be seen, stealing through the trees, and much more quietly than during the day. Then, too, cold has no effect on him, for even when the mercury is at its lowest and the snow is many feet deep, he is abroad, often tunneling through it, apparently merely for the pleasure of the thing. When, however, the wind blows in the heavy storms he makes for his nest, to reappear when it becomes calmer. He is not very particular about his choice for a nest, but makes it in a hollow tree or branch, or sometimes in a log or in the ground. Outside of the colder regions of the Adirondacks he usually builds outside nests. Generally this is in the top of an evergreen, though sometimes in other trees, and is a round mass composed of the bark of the red cedar or other soft material. In this or in the other nest, four to six young are born in the spring. In summer, while these are still to be cared for, the industrious squirrel is already beginning to prepare for the coming of the cold weather and is busily engaged in biting off the young and green cones of the spruce and sweet balsam. In fact, even in the latter part of June, the writer found the ground in parts of the woods near Old Forge covered with the green cones, some of which the squirrel had apparently been sampling. Later, when the white pine and other cones are formed, he bites those off, often doing considerable damage in this way. All these he buries, usually a few at a time, under the leaves or pine needles in the earth, or in the hollows of trees or limbs, and often carries large quantities to his burrow. Later still, when the beechnuts, which form his staple food, are ripe, he collects immense quantities of them, often, too impatient to wait for their ripening, biting off the yet green nuts, so that they fall to the ground, where he afterwards collects them in heaps and then stores them away, as he does his cones. Being thus dependent upon the supply of beechnuts, his numbers vary with their abundance. It seems to be a more or less regular rule that, in the Adirondacks, the beechnut crop is larger every alternate year and the number of squirrels is greatest when the mast is plentiful. Alternate years they are much less common, and from the fact that they sometimes increase or decrease

suddenly in numbers in certain places seems to prove that the squirrels migrate in search of more food. The fact, also, that they are sometimes met with in considerable numbers swimming lakes and streams, and always in one direction, seems to point in the same way.

Besides the beechnuts and acorns which he collects, he often, in more inhabited regions, visits the farm and takes his share from the orchard, where, amid the apples, he often does much damage. Mushrooms also he stores away, and often visits the cornercups for additions to his supply. On these stores he feeds during the winter and appears to have no difficulty in finding them, digging through the snow, no matter how deep. Still he is always on the lookout for any other things he may find, and he may often be seen in the dead of winter feeding on the cones still hanging on the trees. Then, too, his insatiable curiosity leads him into all sorts of places in search of stores that the chipmunk has hidden away. In the spring, when the young buds are swelling, he gets a variety of food, biting off and eating the buds of the spruce, and often covering the ground with the twigs he has bitten off. Hardwood trees, also, are not exempt from him in his desire for green things, and he often does considerable damage in this way.

Then, as the spring advances, one of his worst propensities comes to light. This is his habit of sucking the eggs and destroying the young of the insectivorous birds. In this he is worse than any other of the bird enemies; for, unlike the crows, jays, and the blacksnake, he continues his depredations after the eggs are hatched. This one habit is enough to condemn the red squirrel to destruction wherever one desires to have birds.

In return for this, however, he is preyed upon by the hawks and owls; but they must take him unawares, for in a chase through the tree tops the squirrel has much the advantage. Should he find one of these enemies resting anywhere near him, he at once adopts offensive tactics, and worries the bird till it is glad to get away. Then, too, the red squirrel occasionally falls a prey to the mink or to the weasels, whose long, slender bodies enable them to follow the squirrels into their holes. Besides these, the man and the small boy with the gun are always abroad.

In spite of all these the red squirrel has held his own and in fact has taken to the proximity of man very well, even turning some of man's contrivances to his own account. Thus the zig-zag rail fence is one of his delights, and as Stone says, nothing pleases him better than to run a race with you while you are driving along the road. Then, they like to play tag, and a pair may often be seen chasing each other over and through all sorts of obstacles, with the utmost recklessness. When hunted with a shotgun he soon learns its power, and after



GRAY SQUIRREL (SCIURUS CAROLINENSIS-LEUCOTIS)



that it is often a difficult matter to get a shot at him. In his undisturbed haunts, however, his curiosity often gets the better of him, and when discovered he is just as liable to sit on the branch and chatter and scold and stamp, sometimes approaching closer till he comes right up to you. Merriam tells of one that jumped on his face while he was asleep in camp. This curiosity was the source of considerable trouble in earlier days when there was more trapping in the Adirondacks than there is now; for after sitting on a limb and watching the trapper bait his traps and leave them, down would come the squirrel and spring the trap. True, he was often caught; but that was small satisfaction to the trapper.

The red squirrel is a good swimmer, and may often be seen crossing the lakes and streams with much of his head, back and tail out of the water. This occurs most frequently during the periodical migrations, such as take place at Lake George, where the chestnuts are common on the eastern side, but rare on the western. Sometimes they even cross the widest parts of Lake Champlain.

The gray squirrel, *Sciurus carolinensis leucotis* Gapper, unlike the red, does not like the dense coniferous forests of the Adirondacks, and is consequently absent, or very rare, from the greater part of the interior. On the edges, where the hardwood trees are, and throughout the greater part of the State, he is quite common. The best place to study the gray squirrel is near villages or farms where he is undisturbed; for he is quick to perceive the advantages of civilization, and in our parks he often becomes a most arrant beggar, dependent entirely upon the bounty of man. Still we must not judge the whole race by the degradation of the few; for, though not equalling the red squirrel in activity or industry, he is still a pretty good fellow.

Like the red squirrels, the gray, where he is found in the Adirondacks has his nest in a hollow tree, while in warmer regions he builds outside nests. These closely resemble those of the crow, being placed far up a tree, where a branch leaves the trunk, or in a fork, and are composed of sticks, lined with a softer bark, and with the opening on one side. In them, three to five young are born in April, and in a most undeveloped stage, without hair and with fast-closed eyes. In other regions two litters are often brought forth in one season, the second coming in September or October.

The staple food of the gray squirrel are the beechnuts and butternuts, which are the commonest kinds in the region under consideration, and his abundance, like that of all the squirrels, is dependent upon the supply of nuts. As mentioned before, the beechnut crop is large every other year, and the number of squirrels is greatest in the summer and fall of the following year, for the reason that when the nuts are abundant the squirrels come from all parts, winter

well, and in the spring bring forth their young. Then the young and the old ones together bring the number up to its maximum. Then the nut crop fails and the squirrels migrate, just where we do not know. Merriam finds that a good nut year is a good one for the squirrels' rival, the redheaded woodpecker, between the two of which a constant warfare is waged for the possession of the beechnuts which still hang on the winter trees, and which the woodpecker considers his exclusive property, harassing and driving away the squirrels, who find it easier to steal them than to dig up their own buried supplies. Gray squirrels do not make large hoards of their nuts, but bury them one or two at a time in holes in the ground, and they never seem at a loss to be able to find them.

At the present time the clearing away of the extensive forests which once covered the State, and the change to an agricultural country, has greatly diminished the natural habitat of the gray squirrel, and his numbers, we know from history, are far less than they were 150 years ago. In 1749 they invaded Pennsylvania in such numbers that the entire agricultural district was endangered, and it was necessary to offer a premium of three pence a head for them. As a result 640,000 individuals were killed, necessitating a payment of 8,000 pounds sterling, a large drain on the treasury of a State at that time. Later, in 1764, we find that in the western part of New York they were so common that Munro, in a "Description of the Genesee Country," says: "Squirrels are so numerous in some years as considerably to injure corn; and upwards of 2,000 of them have sometimes been killed in a day, which is occasionally appointed for that purpose by the inhabitants. The most common kinds of them are the black and the red; the gray colored being very scarce." On account of the necessity of combating these the "squirrel hunts" he mentions were organized, all the inhabitants of a certain area who could manage to get any kind of a firearm collecting together at one place and being divided into two parties. Then, from early morn till the sun set there was constant destruction, and then a supper, paid for by the party which had shot the fewest squirrels.

These days are past, probably never to return, for, though we still have small migrations of the squirrels, the immense hosts are gone. Now, even where the squirrels are known to be common, we can wander all day without getting a shot at one, for they are adepts at keeping on the other side of the tree from you, and the tip of his tail, as he goes around, is all you are liable to see.

From the economic point of view there is little to be said about the gray squirrel, for now that his numbers are so depleted the damage they do is but trifling. True, they steal corn and fruit from the farmer, but they are guiltless of the red squirrels' crimes against the birds.

In former times the black squirrel, which is nothing but a color variety of the gray, and the two of which were often found in the same nest, was very abundant, but now appears to be very rare. At least, in the five years of the writer's official experience in the State he has heard of but one live specimen.

Another large species, the fox squirrel, *Sciurus ludovicianus vicinus* Bangs, was formerly found in many parts of the State and occasionally in the Adirondacks. Bachman, in 1839, says: "In the northern part of New York it is exceedingly rare, as I only saw two pairs during fifteen years of close observation." Three specimens, taken in Rensselaer county, in 1853 and 1854, are in the State Museum. It is probably entirely extinct in the State, though occasionally found in more southern regions, which suit them better, as they are more improvident than the gray squirrels, and, not caring to lay up such supplies, they like regions where there is less cold and deep snow.

The eastern chipmunk, like the red squirrel, has recently been divided into two subspecies. Of these *Tamias striatus striatus* Linnaeus, the southeastern chipmunk, which is of a richer, browner color, occurs in New York only in the lower Hudson valley. The other, *T. s. lysteri* Richardson, is of a paler yellow color and is found abundantly throughout the State.

The chipmunk is the only eastern representative of the group of ground squirrels, which are so much more common in the Western States. He is usually seen chasing across the roads or trails, or around the brush heaps, which furnish him with plenty of nooks into which he can dash when pursued, but which still enable him to see what is going on. He is not at all fond of tree climbing and rarely takes to them except when hard pressed, and he is then obviously ill at ease, often preferring to come down and take his chances with his pursuers rather than stay up. Still, with those personal peculiarities, which we so often find in animals, some chipmunks do not appear to mind climbing to a considerable height, and Merriam tells of one he saw making regular journeys from the top of the beechnut trees to his nest. This, in the woods, is usually found with its openings, for it has several, under the roots of a tree or among the rocks. Into this he will dart when pursued, but before his tail has disappeared he will have whisked around and his bright eyes will be peering out at you. Sit down in front of the hole and he will sit there and watch you, occasionally chippering and stamping, darting back at every move you may make. In the hot, sunny pastures, where he delights to live, one of the openings is usually under a rock and the other off in the grass. Stone has described these holes, which are about an inch across at the surface, suddenly widen, go straight down for a little ways and then branch off into the galleries. There is no trace of the excavated earth near

the opening, but some little distance away we find the pile, and it seems probable that the chipmunk, filling his cheek pouches with the excavated earth, carries it away and deposits it there. In these galleries they lay up what, for such a little animal, is a very large supply of food. Audubon and Bachman, in the "Quadrupeds of North America," tell of what they found in a nest occupied by four chipmunks. "There was about a gill of wheat and buckwheat in the nest; but in the galleries we afterwards dug out we obtained about a quart of the beaked hazelnuts (*Corylus rostratus*), nearly a peck of acorns, some grains of Indian corn, about two quarts of buckwheat, and a very small quantity of grass seeds." Besides these stores, they lay up little hoards like the gray squirrel, filling their cheek pouches, which hold an astonishing amount, full of seeds or nuts and burying them in the ground under the leaves.

The chipmunk, like the other squirrels, is dependent for the greater part of its food supply upon the beechnuts, and as the supply of these in the Adirondacks varies from year to year the number of chipmunks also varies. Of course a certain number of them are always present; but in the alternate years, when the nut crop is going to be good, the chipmunks commence coming during September and October. Then they lay up their winter supply, and in the spring bring forth their young. In July of the year when there are no nuts, the number is at its maximum, but knowing that the nut crop will fail that year, most of the chipmunks start to leave in July and soon only a few are left. Besides the nuts, the chipmunk has a variety of other foods. As mentioned before, it is fond of grain and corn, and sometimes digs up what the farmer has planted. They also occasionally eat meat, and their cheek pouches are sometimes found filled with insect larvae. Stone also tells of seeing them catch and eat large grasshoppers. Then, too, they dig up roots, the tuberous ones of the dwarf ginseng and the squirrel corn being favorites. The chipmunks at Old Forge were observed eating the seeds of the maple, from whose papery envelopes they neatly extracted them. Both there and at North Creek their holes could be recognized by the heaps of seeds they had stripped from the spruce cones and the naked stalks. The chipmunk in his search for diversity of food occasionally eats birds' eggs, but is not nearly so great an offender in this respect as the red squirrel.

When the cold days of the late fall come the chipmunk repairs to his burrow; but as several weeks are supposed to elapse before he enters his winter sleep, it is probable that he spends his time laying on a sufficient supply of fat to last him till the spring. Then in the warm, sunny days of April and May he reappears again, but should a cold wave come on he will retire to his burrow for some more sleep.



CHIPMUNK (TAMIAS STRIATUS LYSITER)



Chipmunks, in spite of the familiarity they attain when undisturbed around the house, where they are often perfectly willing to eat out of your hand, do not make very good cage pets, being rather too much inclined to use their sharp teeth.

The Iroquois had an interesting legend explaining the origin of the peculiar markings on the chipmunk's back. It runs thus: "Once upon a time the porcupine was appointed to be the leader of all the animals. Soon after his appointment he called them all together and presented the question, 'Shall we have night all the time and darkness, or daylight with its sunshine?' This was a very important question and a violent discussion arose, some wishing for daylight and the sun to rule, and others for continued night. The chipmunk wished for night and day, weeks and months, the night to be separate from the days, so he began singing, 'The light will come; we must have light,' which he continued to repeat. Meanwhile the bear began singing, 'Night is best; we must have darkness.' While the chipmunk was singing, the day began to dawn. Then the other party saw that the chipmunk was prevailing, and were very angry; and their leader, the bear, pursued the chipmunk who managed to escape uninjured, the huge paw of the bear simply grazing his back, as he entered his hole in a hollow tree, leaving its black imprint which the chipmunk has since retained." We may as well add, "but night and day have ever continued to alternate."*

Two varieties of flying squirrels are found in the Adirondacks, one, the common flying squirrel, *Sciuropterus volans* Linnaeus, being found all around the borders, and another, larger species, the Canadian flying squirrel, *Sciuropterus sabrinus macrotis* Mearns, occurring in the higher central parts. The two species are quite distinct, though they are often found in the same localities, where their habitats overlap. The common flying squirrel measures something over nine inches in length, and is drab above, with under parts pure white, while the other species is over eleven inches long, and on the back is cinnamon brown in summer and sooty brown in the winter, and the fur of the under parts is gray at the base.

Except for the bats, they are the most exclusively nocturnal of our mammals, and for that reason one very rarely sees them. When, however, one is camped in the woods in the warm fall evenings, and, lying under the trees, listens to the many sounds coming from above, then the flying squirrel is conspicuous, and you can hear him as he scolds and drops the shells of the beechnuts he is eating. Then, on cloudy afternoons, he may sometimes be seen sailing from one tree to another, but it takes a pretty dark day to bring him out, and such occasions are rare.

* E. A. Smith. Bureau of Ethnology, 2d Rept., p. 80. 1883.

Flying squirrels are the most highly specialized of the squirrels in regard to an arboreal life, and the folds of skin which extend between the legs enable it to make far greater leaps than any of the other squirrels. It is, however, quite unable to sail horizontally, so its first move is to climb some distance up a tree and then make its leap from there. Audubon and Bachman describe most interestingly a number they once saw: "At times one would be seen darting from the topmost branches of a tall oak, and with wide extended membranes and outspread tail gliding diagonally through the air till it reached the foot of a tree about fifty yards off, when at the moment we expected to see it strike the earth it suddenly turned upwards and alighted on the body of the tree. It would then run to the top and once more precipitate itself from the upper branches, and sail back to the tree it had just left. Crowds of these little creatures joined in these sportive gambols; there could not have been less than two hundred. Scores of them would leave each tree at the same moment and cross each other, gliding like spirits through the air, seeming to have no other object in view than to indulge a playful propensity."

Flying squirrels make their nests in hollow trees, often using the holes that have been deserted by the woodpeckers. Here, early in the spring, they bring forth their young, and according to all accounts they make most interesting and attractive pets. As so little can be said of their wild life, we cannot do better than to quote some of a description of them given by Prof. G. H. Perkins: "At dusk they begin to stir. Not all at once, it would seem, do they awake, for the material of the nest quivers and shakes for some time before the squirrel appears. When, however, they conclude that they are all ready, out pop their heads, each to be followed by the rest of the body, after a glance on all sides with the glistening black eyes, and now all drowsiness has disappeared and an activity more incessant and intense than can be described takes its place. All night long, often with only the briefest rest now and then, these little animals are in vigorous motion, jumping, bounding, capering, running with ever-varying movement and astonishing energy. Everything they do is done with all their might. It would seem to anyone watching them that the exercise of the first few minutes must wholly exhaust their powers; but, on the contrary, the more their muscles are used the more capable of use they seem, and great as is the energy of their movements at first, they usually increase in vigor and speed until after midnight and scarcely grow less before morning. Nothing affords them so much gratification as a large wheel which is placed inside the cage. Into this wheel they jump whenever aught disturbs or pleases them, and even when quite hungry they often find it necessary to take a few turns before commencing their meal, after which

exercise they draw themselves into a bunch with the tail over the back after the manner of squirrels, and set briskly to work on the nut or other food which they may have received. They are almost as fond of riding as of running and work their passage by running till the wheel is in rapid motion and then clinging to its wires, and so are carried around and around, the pure white of the under side of the body contrasting prettily with the soft brownish gray of the back and sides as each comes into view. When both are in the wheel one often rides while the other turns the wheel, the latter bounding over the other as each turn brings him around, and no matter how rapidly the wheel turns these movements are executed with perfect exactness and gracefulness. Being desirous of knowing with some degree of accuracy how rapidly the wheel moved, I made some experiments for the purpose and found that the usual rate of revolution was from sixty to over a hundred and twenty times a minute, and, as the wheel is forty-four inches in circumference, when its rate is the latter of the two numbers named, the squirrel turning it must travel four hundred and forty feet a minute, or about five miles an hour, a distance requiring a great many steps when they are as short as squirrels must take. The sides of the wheel are formed of spokes radiating as in any wheel; these spokes are only five inches apart at the circumference and of course constantly grow less towards the center; yet through this narrow space which passes, when the wheel is at full speed, in the sixteenth part of a second, they dart in and out with perfect ease. So quickly do they move that the eye can scarcely follow them; one instant the squirrel is in the wheel running with all his might, and the next he is seated on a shelf at the opposite end of the cage, the wheel whirling behind him. * * * Indeed it is impossible for them to be awkward or clumsy in any of their movements. Though usually very quiet, they are not always displeased with noise, if it be a lively one; for instance they drop a nut in the wheel and then as it rattles while the wheel moves they are highly delighted, sometimes more so than some of the other listeners. * * *

Now and then the freak takes one or the other to leave the wheel altogether for several days, and in the meantime they relieve their over-buoyant feelings by executing a brilliant series of somersets with an agility and daring that would excite the envy of the most skillful acrobat. They always turn backward, going completely over and alighting almost exactly upon the spot from which they started. Now they run a few steps before going over, and now stop and turn round and round as if a spit ran through the center of the body, on which it turned. * * *

I once found one of them at my inkstand eagerly lapping the ink as if he enjoyed it greatly; pretty soon, however, he left it with sneezings, sniffings and grimaces of a most comical sort, but the next chance he had he tried to get

some more. Salt they eat greedily and also sugar. Beetles they are very fond of and several birds' eggs which I left in their way they devoured, shells and all.

* * * When the actions of an animal are so suddenly varied, so constantly changing and of such interest in all their phases as are those of the flying squirrel, a complete account can scarcely be given. Certainly it is not easy for words to represent the merry, rollicking, don't-care manner in which these flying squirrels do everything. Such a combination of earnestness and carelessness are seldom seen. For they are earnest about their work, and in emptying a box of nuts they seem to feel the great importance of their undertaking and the necessity for soberness and dignity in its execution; but yet one cannot help seeing that all this is but assumed for the occasion, for their eyes, and indeed their whole body, are all the time expressive of mischief, and the little rogues are never so sedate that they do not seem to be bubbling over with fun and to be ready at a moment's notice to engage in any mischief that may occur to their scheming little heads." *

Like all the other squirrels, these feed on nuts, seeds and buds and appear to have a liking for flesh, and can often be taken in traps baited with meat. From their quick and noiseless movements, it seems probable that they can and do prey upon the small birds which spend the night in the trees.

The northern flying squirrel is a more hardy animal than the common one, and no amount of snow or cold is enough to drive him to his nest in the winter nights. Like the red squirrel, his curiosity, combined with his hunger, lead him to investigate every out-of-the-way object, and he is therefore almost as much of a nuisance as that hardy adventurer. Even the fact that the trap is baited with one of his captured brethren does not seem to deter him from investigating it and getting caught.

The remainder of the New York rodents are nearly all small forms and include the rats and mice and the lemmings. The latter are hardly to be distinguished from the mice, and are inhabitants of cold sphagnum bogs, in which they make their burrows, and where there is an abundance of the vegetable matter on which they feed. They are close relations of the lemming of Norway, whose extensive migrations in enormous numbers are well known. There, when driven by overcrowding and consequent lack of food, they start out, urged by some impulse, stopping neither for towns or broad streams, devouring everything they can which comes in their way and only end by coming to the sea, into which they plunge, still going onward, and are drowned. As far as we know,

* American Naturalist. Vol. 7, p. 129. 1873.

our American forms are not subject to such migrations. Two species are found in New York State; but of these, one has been taken but once.

The rats and mice are more common—in fact, too common by far. Of the former, the common or Norway rat is found everywhere in inhabited districts, though he has failed to penetrate in very great numbers very far into the Adirondacks. He is not a native species and according to De Kay, was introduced by the foreign mercenaries during the Revolutionary War. Though they are intelligent beasts, they are unattractive in appearance, and are probably as little liked as any animal. They are of some value as scavengers, but do far more damage, and are therefore only regarded as a nuisance.

Before them came the black rat, which was also introduced from Europe, and which spread throughout the country and was found in many parts of this State. This was rather more attractive in appearance than the Norway rat, but the latter has entirely driven him out, and he is now probably extinct here. This process has been repeated throughout the world, and the black rat now exists only in places to which the Norway rat has not penetrated.

Like the rats, the house mouse is not a native species, but, originating in southern Asia, they have gone with man wherever he has traveled, and now are spread throughout the entire globe. This migration is still going on, and probably there is no vessel that sails that does not either leave some on this side or carry back toward their native land some specimens of the house mouse. Their habits are too well known to need description here.

Of the species of native mice, the jumping mice are interesting little forms, with long tails and long hind legs, with the aid of which they make astonishing leaps, when they want to get away. There are two species of them in the State, and the woodland jumping mouse is found throughout the Adirondacks in the deep woods, making its nest under the laurels and hemlocks beside the brooks.

Another pretty little mouse, common in the woods, is the whitefooted mouse, often called the deer mouse. In their native haunts they make their nests high up in the hollow trees or in logs, or in burrows in the earth, but it has been quick to see the advantages of civilization, and is now often found in the houses. Here it lives in harmony with the house mouse, taking its share of any food that may happen to be around. In its wild state the whitefooted mouse lives mainly on beechnuts and almost any kind of seeds, of which it stores away an immense quantity in its nest. During the winter it feeds upon these, but the coldest weather seems to have no effect upon it, and it may often be seen running over the snow in search of more food. In captivity it becomes very tame and makes a most interesting and attractive little pet. Some individuals appear to have the

gift of song, with most musical, bird-like notes. It may be said also that sometimes the same ability is present in some of the house mice.

The mice which do the greatest damage, however, in the country are the redbacked mouse and the meadow mouse. Of these, the former is the smaller and may be recognized by its chestnut color. It prefers the woods and clearings and the vicinity of bogs, where they make their burrows just under the surface, and their nest under some log and pile of bark. They feed on seeds, berries, and various kinds of roots, and, during the winter, on the bark of shrubs and trees. The writer found a very serious, though limited, case of damage by this mouse at Paul Smith's, where they had been exceptionally plentiful during the winter, and had attacked everything, including even some of the softwood trees. Within this area they had stripped off all the bark from the larger exposed roots and from the trunk, up to a height of about four feet. It is probable that the presence of an abundance of food from the hotel had originally attracted them, and then, not finding enough food in the winter, they had attacked the trees. Along the roads near the same place, there were many dead saplings, which were apparently the results of the work of either this species or the meadow mouse. These were usually girdled within a foot of the ground, and the marks of their sharp teeth could be seen on the underlying wood. They were particularly partial to the maple and ash; but beech, alder, and wild cherry were also attacked. This meadow mouse is probably the most destructive of any; for, not liking the deep woods, he is fond of settling down in the meadows and pastures, where he lives upon the roots of grasses and clover. Then in the winter he attacks the young fruit trees in the nurseries and the shrubs around the farm, girdling them and often killing them. During the summer they live in burrows; but when the ground becomes frozen they abandon these and make a nest of dry grass upon the surface of the ground, with runways going off in all directions. Soon the nest is covered with snow, but the heat from the bodies of the mice soon melts a dome-shaped chamber over the nest and from this they tunnel through the snow in search of food. It is then that they do the damage to the trees, for the snow enables them to work well up the trunks and at the same time protects them from the weather. Usually they are not sufficiently numerous to attract very much attention to their depredations; but occasionally, though rarely, they multiply in such numbers that the damage is very extensive. Whether this abundance is due to migrations or simply to conditions favoring unchecked reproduction is not known. One of these conditions is the destruction of the birds and mammals which prey upon the mice, and Merriam has these pertinent remarks concerning this: "The amount of food consumed by a single individual is of course compara-

tively insignificant, but that required to sustain the total number inhabiting a given district is not to be ignored. And when it is borne in mind that the food of this species consists almost exclusively of the produce of the agriculturist, the fact becomes evident that the animal is a source of continuous pecuniary loss to the farmer. Omitting reference to the years when the species is present in excessive numbers, it is a low estimate to say that twenty-five mice live upon every acre of meadow land. Hence the total number present upon an ordinarily productive farm of two hundred acres would not be less than five thousand. Now suppose that the owner of a farm of this size should capture and keep in confinement five thousand meadow mice, feeding them upon their natural food grain and the roots of grass. Would it not be strange if, in the course of a few months, he should become so alarmed at the cost in dollars and cents of keeping such a host of these ravenous creatures that he should have them all put to death? And yet our farmers not only look on in stolid indifference while their property and the fruits of their labors suffer, from this source, annual losses which they can ill afford to bear, but they even help the mice to increase in numbers and maintain supremacy over their fields! This they do in several ways, chiefly by neglecting measures for the riddance of the mice, and, what is of vastly more consequence, by encouraging the destruction of those birds and mammals that habitually prey upon mice. Preeminent among these may be mentioned the marsh and rough-legged hawks, all the smaller hawks and owls, the shrike, the skunk, and the weasels. Thus the farmer in his shortsightedness omits no opportunity to deprive himself of Nature's means of holding in check the vermin that ruin his crops."

The following works may be consulted by anyone interested in a further study of the group. More detailed bibliographies will be found in the papers by Miller and Stone.

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The Wild Fowl of the St. Lawrence River

BY J. H. DURHAM.

SINCE the advent of the white man into the valley of the St. Lawrence River the region of the Thousand Islands — “Les Milles Isles” of the Canadian voyageur — has been noted as a resort for wild fowl innumerable; and as a natural consequence it has become a veritable paradise for the sportsman, and also that other accompanying evil, the mere “pot hunter.”

A glance at a map embracing the watershed of the upper St. Lawrence river, that extent of country known to the Algonquin by the name “Cataraqui,” signifying, “A land of many lakes,” and which includes that cluster of inland island dotted lakes, rivers and creeks lying back of Kingston and Gananoque, on the north, and the lakes and streams of Jefferson and St. Lawrence counties on the south, will convince the most casual observer that nature here dealt her favors to the feathered flock with no niggard hand. The constant succession of rocky ridges, fertile valleys, wide reaches of wooded plateaus, low-lying meadows and marshes, sedgy swamps with here and there a “salt lick,” was an ideal range for myriads of wild fowl and herds of four-footed game.

As a matter of fact, Lake Ontario, including Bay de Quinte, was “Cataraqui” lake; the St. Lawrence river was “Cataraqui” river; and the whole region on both shores, as I have indicated above, was the paradise of the red hunter, whether of fish, flesh or fowl.

In view, therefore, of all these natural advantages, there is little wonder that the red tribesmen fought furiously for the possession of this “land of many lakes,” where everything they most craved was so abundant, in variety so great, and so easy to procure; but so it was, until the white man came, and drove the red men from their hunting grounds, and then proceeded to destroy the game recklessly and in some localities to almost completely eradicate every vestige of it.

To-day, governments, through the medium of laws and special enactments, are trying, with only partial success, to preserve some few remnants of the many species of fish, flesh and fowl which Mother Nature distributed with lavish hand among the ideal haunts in forest, lake and stream; and which are now almost extinct



J. E. STANLEY, PHOTO

SEA GULL EATING A FISH.



J. E. STANLEY, PHOTO.

RETRIEVING A GULL.



in some localities, through wanton and reckless destruction. To effect the desired result, more stringent laws are necessary, a more rigid enforcement of those we have, and a more thorough supervision everywhere.

The territory embraced by the Thousand Islands and the foot of Lake Ontario is practically the game center of the region to which I have alluded; since every species of wild fowl known to those localities will be found within its borders at one time or another during the season. The object, therefore, of this article is to briefly notice the different species of fowl and shore birds that yet breed here, or make it a resort at their usual periods.

I am glad that I am able to state that the species common here are still numerous, notwithstanding the encroachments of civilization in the way of summer cottages upon the shores and islands of the lakes and rivers, with all the accompanying accessories of innumerable water craft, from the great steamer down to the steam and motor yacht, the launch and skiff, which are constantly increasing every season among our watering places.

Indeed, no better proof is needed of the adaptability of this region to the habits of wild fowl than the fact that, despite the difficulties and, to them, dangers of constant encroachments upon their haunts, they instinctively return thereto year after year to rear their young, and then fall a prey, perchance, to the enthusiastic sportsmen; and, too often, I am sorry to say, to the greed of the mere pot hunter.

In the following notes I have confined myself to the briefest descriptions, for which I am mainly indebted to the "Color Key to North American Birds" and "Birds of Eastern North America," by Frank M. Chapman; and to Mr. James E. Stanley, of Cape Vincent, N. Y., a noted taxidermist and an enthusiastic ornithologist, for the privilege of verifying some of the descriptions by an examination of many of the exquisite specimens with which his cases are liberally supplied. I am also indebted to Mr. C. T. Sacket, also of Cape Vincent, for the privilege of research through his extensive library, to me a source of great satisfaction.

I am also indebted, in some measure, to Gurdon Trumbull's "Names and Portraits of Birds," more especially for the scientific names, although in some instances I have followed Mr. Chapman in that respect, because his classification seemed to me to be the most logical. I make no claim, however, to any expert knowledge of bird nomenclature; so, where the "doctors disagreed," I have chosen—it may be neither "wisely nor well"—and I trust I am not far wrong. I am also much indebted to "Our Feathered Game," by that entertaining writer and sportsman, Dwight W. Huntington.

Ducks (*Anseres*).

I commence my descriptive list with the ducks, because the species is by far the most numerous of any of the water fowl that frequent this locality.

Of the forty-nine species of the duck family (*Anatidae*), twenty-seven are found in this locality. By locality I mean the St. Lawrence River region. Some of them breed here, while others remain until very late in the season. Again, some species are numerous, while of others only an occasional specimen is obtainable.

MERGANSERS (*Merginae*).

Three species of the Merganser family are found here. The American merganser (*Merganser americanus*) is common, during the season, to all parts of the river and lake.

The mergansers are called ducks in common parlance, though in fact they do not seem to belong to the true ducks, only in some particulars; in others, they differ materially. This part of the subject, however, I leave to the scientist. As game birds they will have to be included, I suppose, among others of the inferior class, though I suppose that if nothing better is in sight the average gunner will not let the chance to bag one pass by. They are voracious devourers of fish. Mr. Allan Brooks, in the March number of *Recreation*, avers that a "Sawbill" can "digest five pounds of fish daily." This being admitted, it is easy to conclude that the merganser does not rank high as a table delicacy. In fact, as I have had occasion to remark of another bird, it would scarcely be accounted a sin to eat one on a Friday because of the difficulty in distinguishing whether fish or flesh predominated.

The mergansers are all birds of beautiful plumage, the American merganser being superior in that respect to any of the others. They are all tree breeders, and to some extent they all breed at some point within the St. Lawrence River region. In fact, the American merganser is essentially an inland dweller, though not so numerous here. It is an early breeder; the young ones are very precocious, being able to take small fish before they (the birds, not the fish) are fairly feathered out.

Sheldrake and sawbill are names often used locally for all the mergansers indiscriminately, though when applied to the hooded merganser the name is usually qualified by "little"; as little sawbill, little spikebill, etc. The American merganser is described as follows: "Head and crest black, reflecting green; upper parts black; rump and tail coverts gray; wing white with black bar; under parts salmon color; tail gray; bill and feet red."



HOODED MERGANSER,
UPPER FIGURE MALE. LOWER FIGURE FEMALE



The red-breasted merganser (*Merganser serrator*), locally known as the "Red-breasted sawbill," breeds here, and is well known to sportsmen throughout the entire region. This bird decoys easily. It subsists entirely on fish, and therefore is no better for table use than its congener, the American merganser.

Just here I am reminded of a recipe for cooking a merganser, which was given me some years ago by one of our local guides, now deceased, who was so good a camp cook that his "shore dinners" became widely celebrated and were eagerly sought for by our summer visitors. He used to say: "I use the 'soup stone' receipt." Further inquiry developed a little story, to this effect: A "way down easter" decided to take a look at the "far west," which was at that time limited by the Mississippi River. Being light in purse and withal of a saving disposition, instead of putting money in his "scrip," he put a smoothly polished oval stone of strange and variegated markings and colors in its place, shouldered his knapsack, and set forth on his travels toward the setting sun.

Stopping at the old-time wayside taverns (hotels were not known in those days), he readily, Yankee fashion, ingratiated himself, first with the landlord and his family and then with the guests, with whom he skillfully broached such subjects that a showing of the stone was necessary, by way of illustration. Of its virtues he was at once secretive, yet eloquent and enthusiastic. Of course, there were doubters; and the only thing that remained for our traveler to do to sustain his reputation for truth and veracity was to submit to a trial of the virtues of the stone then and there.

To this he agreed; but he said: "Gentlemen, you must understand that the virtoos of this stun are in its flavorin' and thickenin' qualities. It don't make the hull soup of itself; there are other ingrejunts necessary, which, if I had, I would show you in——" "Just name 'em," said the landlord, "and they will be forthcomin'." "A fryin' pan, some bilin' water, a pertater or two, a small ingun, and a passnip ef handy; a slice or two of bread, and a spoonful or two of injun meal; and a leetle salt and pepper," enumerated the traveler.

The "ingrejunts" were "forthcomin'" in short order, and to them our Yankee friend silyly added a bay leaf; and when everything was properly prepared for its reception, and as our friend remarked, the "witchin' time had arriv," the "stun" was carefully placed in the center of the seething mass. In a few minutes it was taken out, carefully cleaned and put away, the soup was turned out into a dish and duly sampled by everyone present, and pronounced perfect as to "body and flavor." It is needless to say that our Yankee friend had demonstrated the "virtoos" of the "stun," and that he consumed the bulk of the soup himself,

and departed satisfied, to repeat the demonstration at the next tavern. Reader, you have the recipe; and should know by this time how to cook a merganser.

DESCRIPTION. "*Adult male.* Breast, with broad cinnamon band, streaked with black; head feathers lengthened. *Female.* Crown grayish brown, washed with rusty. Chin and throat paler; rest of underparts and speculum white; back and tail ashy."

THE HOODED MERGANSER (*Lophodytes cucullatus*).

This bird is also very common, being one of our best known tree breeders, staying with us until very late before migrating.

DESCRIPTION. "*Adult male.* A large circular black and white crest. *Female.* A small cinnamon crest; head, neck and breast grayish brown; back blackish; belly white."

By some of our local sportsmen, this bird is known as the "hooded sheldrake." It is smaller than the other mergansers, and is oftener found on ponds and sluggish streams.

THE MALLARD (*Anas boschas*).

This is one of our commonest birds, breeding largely, when undisturbed, in the marshes of the bays and among the islands. The mallard is the original of our domesticated duck, with which it readily mates; and from the fact that the mallard has the familiar *quack* of the barnyard duck there are times when it is difficult to distinguish them. This similarity leads sometimes to ludicrous mistakes, not to say costly ones also, on the part of amateur duck hunters, to whom a duck is just a duck, and to whom the difference in the species is a sealed book.

A case in point occurred not many years ago in this immediate vicinity. A couple of young hunters, from a city which shall be nameless, went duck shooting, armed with the most approved weapons in the way of breechloaders, shooting jackets of the best material and latest pattern, gorgeous gamebags, and, in short, all the paraphernalia ever invented to make the taking of wild fowl at once a pleasure, pastime and success. They were accompanied also by a well-trained retriever.

Evidently, they had been informed by some friend, who had been here before, of the best locality for game on which to exercise their skill; for without any hesitation or inquiry of any kind they engaged a boatman to take them at an early hour the next morning to a bay in a nearby Canadian island, where the *Anas boschas* breeds numerously, and where in several instances it has been known to liberally mingle its wild blood with its congener of the barnyard.



J. E. STANLEY, PHOTO.

SNAPPING TURTLES IN QUEST OF YOUNG BIRDS.



Landing his sportsmen at a suitable point, the boatman rowed away, so that the sport might not be disturbed by his presence, and yet be where a signal to return could easily be seen. In a little time the firing began, and soon grew fast and furious. Afterward, the old boatman, who was a veteran of the Civil War, said, while indulging in a brief reminiscence of the occurrence, that "from the sound of the firing he thought that his men had formed a skirmish line and opened fire on the Canadian garrison at Kingston."

However, they soon made the signal agreed upon, and taking them on board he rowed away for the hotel. They were elated with their success. Their game bags were filled to repletion, and they had several brace each, besides. They were elated with their wonderful success; even the eyes of the panting retriever sparkled with pleasure. Their success had been phenomenal, and not caring to dim its brightness by any chance of future failure, they concluded to take themselves and trophies home on the evening train.

A dinner, such as mine host Fox always provided, with perhaps certain accompaniments usually printed on the back of the bill of fare, only added to their elation. They repeated again and again to a circle of envious admirers just how they did it, the pith of which, as told by the chief narrator, was: "A big flock of these mallards—that's what they call 'em, isn't it?—came swimming around the point and we let them have it right and left; and, by George, gentlemen, we got all but one; all but one, gentlemen, for a fact."

Just then, an old farmer and his son and hired man, who lived over on the island, came in and after complying with an invitation to share in the liquids, turned to inspect the game. But why prolong the painful scene? The hunters, now become the hunted, paid for the mallards, and something over, and were allowed to retain them. The old farmer remarked suggestively that he thought likely he could have another flock ready by next year. Full of newly acquired knowledge and other things, those hunters went home on the next train; and whether or not their friends ever learned their mistake as to mallards, the deponent saith not.

This is not the only case of the kind by any means, and similar mistakes are liable to occur again.

The common method employed here for shooting mallards is over decoys; and among all the species which frequent this region the mallard is undoubtedly the favorite with a great majority of hunters.

Another incident, related to me by Mr. James E. Stanley, shows what may be accomplished by an amateur hunter whose knowledge of the game he seeks is practically "nil."

Mr. Stanley had placed a fine lot of decoys in Mud Creek, a couple of miles or so from the village of Cape Vincent. Himself and Mr. Henry Morrison, one of our enthusiastic local gunners, had placed themselves in the proper positions to await the incoming of the expected game, when they were startled by an unexpected fusillade from a clump of undergrowth not more than thirty feet from the decoys, and yet more startled to see the split, mangled and disfigured decoys floating recklessly about in badly disheveled, duckly dignity. It would be hard to imagine a more astonished individual than was the unlucky amateur when Mr. Stanley pounced upon him with an outflow of language not only emphatic but lurid. The fellow was so completely dumbfounded that he could only exclaim: "Great Scott! ain't them ducks nothin' but wood?" An undeniable compliment to Mr. Stanley's skill as a decoy maker. In consideration of his dense ignorance, Mr. Stanley "let him down easy." And he went away, a "wiser" if not a sadder man.

DESCRIPTION. "*Adult male*. Head green; breast chestnut; a white neck ring; speculum purple bordered by black and white; under surface of wing pure white. *Female*. Above blackish and buffy; below rusty buff mottled with dusky grayish brown."

Other species of this family common here are the black duck (*Anas obscura*), also a home breeder.

The black duck closely resembles the mallard in its habits, and the "quack" of the mallard, the black duck, and that of the barnyard fowl are so nearly alike that one might easily be mistaken for the other. Mr. Stanley has a pair bred from the black duck and the mallard, and now proposes to continue the new strain in order to see the result. His opinion is that they will "breed back;" and he is waiting with no little curiosity as to the outcome. A Wolf Island farmer tells me of an instance in which eggs of the domestic duck, the mallard and the black duck were found in the same nest not more than a rod from the water's edge.

The black duck is an exceedingly cautious bird, and not easy to take. Owing to the nocturnal habits of the species, some of our local hunters formerly indulged in night shooting, but with no marked result, other than to drive the birds from their feeding grounds.

DESCRIPTION. "*Adults*. Speculum bluish purple, tipped with black; no white in the wing; wing lining white; crown without paler margins; throat usually without markings; legs 'olivaceous' brown; bill greenish black or olive green."

The gadwall (*Anas strepera*), which is not so common here, often goes by the name of the "gray duck," and is often confounded with the widgeon. In fact,



J. B. STANLEY, PHOTO

MOSSBACK TURTLE EATING A GALINULE.



some of our local hunters insist that the gadwall and widgeon are the same bird. It breeds in our marshes, but not in great numbers.

DESCRIPTION. "*Adult male*. Wing coverts chestnut; under wing coverts and axillars white; breast ringed with white. *Female*. Head and throat like male; back fuscous and buffy; breast and sides ochraceous, thickly spotted with blackish; speculum ashy gray and white."

The widgeon (*Anas americana*). By some of our gunners this bird is known as the "green-headed widgeon," or "greenhead," and also the "bald pate." Owing to its extreme wariness it is not only hard to take, but it often succeeds in frightening other birds away with its peculiar alarm signal, a sort of whistle.

DESCRIPTION. "*Adult male*. Head and neck reddish brown; crown buff; sides with wavy white and black lines. *Adult female*. Head and throat rusty, finely streaked and barred with black; breast and sides rusty; speculum blackish."

Two species of teal are local breeders also; the green-winged teal (*Anas carolinensis*) and the blue-winged teal (*Anas discors*). The latter is also locally known as the "white-faced teal." These are the smallest of the wild fowl that visit this region, or that breed here. They are much sought after, as they are considered superior to the canvas back for eating. This question of suitability for table use is, after all, a relative one. It depends wholly upon the quality and kind of food the birds consume. Those that feed upon the wild celery of the South, or fatten upon the wild rice found in so many localities, are superior in flavor to those that feed upon inferior foods. Generally speaking, however, teal are excellent table birds, inferior to none.

The blue-winged teal are among the earliest to visit us, arriving here early in September. Many remain to nest in our marshes, unless too often disturbed. They are rapid flyers, and rise from the water quickly. The usual method of taking them here is with decoys, or shooting over points.

DESCRIPTION. "*Adult male* of the green-winged teal. Wing coverts gray, tipped with buff or white, a white crescent in front of wing; speculum green, bordered by black, tipped with white. *Female*. Wings same as male, throat and sides of neck white, finely spotted with black; breast and sides rusty, marked with black. *Adult male* of the blue-winged teal. Blue wing coverts, and white cheek patch. *Female*. Resembles female green-winged teal, but has wing coverts blue, with speculum greenish brown."

The canvas back (*Athya valisneria*). Though not by any means as common here as some other species, it visits us in considerable numbers and is often bagged. The usual method of taking them in the St. Lawrence region is by shooting over decoys, or from points as they pass from one feeding ground to another.

DESCRIPTION. "*Adult male*. Head and whole neck dull reddish brown. *Female*. Head and neck rusty grayish brown; back grayish brown finely barred with black and white."

The canvas back is one of the largest of the duck family, and is also a handsome bird, qualities which, combined with its excellent table qualities, have given to this species the distinguished name, "King of Ducks." It arrives here quite early in the fall, and remains until there is no longer any open water to be seen.

Dwight W. Huntington, in his admirable volume on "Our Feathered Game," says: "The canvas back is distinctly an American bird. No other ducks resemble it excepting the red-head duck, and the pochard of Europe." This fact accounts for the opinion expressed by an enthusiastic southerner in an after-dinner speech that: "Sah, the only bird that should be adopted as the emblem, sah, of these United States is the canvas back of the Chesapeake, sah."

The red head (*Athya americana*). By many of our epicures, this bird is thought to be much superior to the canvas back for table use, and hence they are much sought after. These birds usually arrive here late in March, or certainly by the first of April, and now that spring shooting is prohibited, they will remain until late in the spring, and no doubt many will breed here. The method of taking them is the same as employed for the canvas back.

DESCRIPTION. "*Adult male*. Head and upper neck entirely a bright rufous; lower neck, breast and back of the neck and upper back black; the rest of the back and scapulars finely barred with wavy black and white lines of equal width; wing coverts brownish gray; upper tail coverts black; belly white, lower part more or less barred with black. *Female*. Throat white; back grayish brown without fine bars; speculum gray."

The American scaup or bluebill (*Athya marila*).

DESCRIPTION. "*Adult male*. Head glossed with greenish; sides without distinct black bars. *Female*. Feathers about base of bill white; breast and back rusty grayish brown; speculum white."

The lesser scaup, or little bluebill (*Athya affinis*).

DESCRIPTION. "*Adult male*. Head glossed with purplish; sides with distinct black bars. *Female*. Similar to female of American scaup." This bird is common and is often taken among the islands and in the bays.

As indicated, there are two distinct species of the scaup showing no appreciable difference except in size. They have several names, but the most common seems to be the "big bluebill" and the "little bluebill." Though these birds are often mistaken one for the other, so far as I have been able to learn it is the lesser scaup or little bluebill that is oftenest seen here.



PINTAIL DUCK
UPPER FIGURE MALE, LOWER FIGURE FEMALE



The ring-necked scaup (*Athya collaris*), though partial to our lakes and ponds, is not so often met with along the river. With the exception of a chestnut collar or neck ring, this species does not differ materially in its markings from the other *Athyae*.

Another species, the pintail (*Dafla acuta*), known also as the "piketail" and "sprigtail," is sometimes found here, though by no means common. It is distinguished principally by its central tail feathers, which are black and about seven and a half inches in length.

The pintail arrives here usually in September, but sometimes it is not seen until October. When the teal put in an appearance the pintail may be looked for. Huntington speaks of a remarkable performance of this bird, that of drumming like the snipe, arising high in the air, and then falling suddenly, producing a loud drumming sound by the action of the wings. It frequents our marshes with the mallard, and is often shot over decoys at the same time. It is one of our best table birds.

A favorite bird here, because of its superior table qualities, is the shoveller (*Spatula clypeata*), often known to our sportsmen as the "red-breasted shoveller." For table use it also is considered by many far superior to the canvas back.

In plumage it is one of the most beautiful birds that visit us; and hence I indulge in a description of an adult male, as given by Mr. Gurdon Trumbull: "Head and upper neck of a very dark greenish tone with purple reflections; lower neck and breast white; belly and flanks rich chestnut brown; front part of wing conspicuously blue, of light shade but vivid; back of this blue, a green wing mark or speculum, bordered with white and black; feathers striped with white sweeping backward from inner region of wings; back dusky brown; rump above and below tail black with greenish gloss; at either end of tail a white patch." Though not especially numerous, enough of these birds are seen from time to time to keep the epicurean sportsman on the *qui vive*, in the hope of securing a brace or two for his game bag.

One of our home breeders, conceded to be the most beautiful of our water fowls, and scarcely inferior to any for table use, is the wood duck (*Aix sponsa*), also called the "summer duck." I refrain from attempting a description of this beautiful bird, because mere words can give no adequate idea of its gorgeous plumage; and, moreover, it is so well known that description is superfluous. Only a colored plate could give an appreciable idea at the best. Mr. Huntington says: "The wood duck is the most beautiful duck in the world."

Linnaeus named this bird *sponsa*, the bride; but that seems rather inconsistent, since it is the bridegroom that appears in gorgeous raiment, while the bride is a plain little body, very modestly attired.

There was a time, and that not long ago, when it looked as though this species would become extinct; indeed, in some localities where they were numerous a few years ago there is now hardly one to be found. Notably is this the case along the wooded shores of Kent's or Mud Creek in the town of Cape Vincent, Jefferson County. There the species has been pretty thoroughly obliterated; and unless the law against spring shooting is promptly and thoroughly enforced, we may bid farewell to the wood duck in that locality. Hon. Elon R. Brown, when he procured the enactment of the law against spring shooting in Jefferson County, performed a meritorious and most creditable act; and now, if the officers to whom the enforcement of the law is entrusted will do their duty promptly and effectively, great good may be accomplished. It is a source of regret that the provisions of the law were not extended to other counties, especially those embraced in the lake and river region.

It may be considered somewhat out of place to make a suggestion here; but I hope that it is not wholly inappropriate. In view of the fact that the area of cleared land is constantly increasing, and in the same ratio the wooded area diminishing, so also are the nesting places of many of our home breeders, such as the wood duck and other tree fowl, becoming fewer and more difficult of access to the birds. In proportion as suitable nesting places grow less the broods fall off; and these causes, in connection with corpulent game bags filled to repletion by greedy hunters, soon result in ridding us entirely of these species.

My suggestion is, that a law should be passed limiting the number of ducks and shore birds to be taken at any one time to not more than a dozen. Anglers are limited to taking a certain number of bass at any one time. Why not extend the law to fowl? Bass are a hundred times more numerous than our game fowl, and yet I have seen as many ducks brought in, the spoil of a single gun, as the angler was allowed bass as the trophy of a single rod. The true sportsman ought to be satisfied with half a dozen brace of ducks, while the pot hunter should be legislated out of business entirely. What really ought to be done, is the enactment of a law prohibiting the killing of any of our home breeding birds, ducks especially, for a term, say, of five years. At the end of that period duck shooting would be a pleasant pastime, and there would be some chance that now and then a choice morsel might reach our tables.

My attention has just now been called to another fact which may be very properly considered by our lawmakers, and that is, that one of the greatest enemies of the wood duck in this locality is the pickerel, so called here, but properly the pike. These fish are classed among game fish in our waters, a bit of the most inconsistent legislation on our statutes. The pickerel destroys more bass spawn,



Levi Agassiz Fuertes.

GOLDEN EYE AND
MALLARD DUCKS IN WINTER DRESS



except perhaps the eel, than does any other of the finny tribe; and besides its sins in that direction it is doing no end of damage in the destruction of young ducklings. Pickerel are to our wood duck and other home breeders what carp have proved to be elsewhere.

The law should relegate pickerel to the grade of food fish and turn them over to the netter. By so doing a double benefit would be achieved. There would soon be a notable increase of bass and also of our home breeding ducks, while there would be, in addition, a marked increase in fish food. It seems like folly to protect a fish by law that no true angler would think of keeping should he catch one.

Another tree breeder, the American golden eye, or whistler (*Clangula americana*), is also common on the St. Lawrence, returning here from the north in autumn. The golden eye is never seen in large flocks; often single or in pairs. It is a rapid diver and as difficult to shoot as a loon. The flesh is not especially desirable. I quote again from Huntington: "The Indians call it a 'spirit duck.' On the Yukon they stuff the skin to make a toy for the children."

In Neltje Blanchan's book, "Birds that Hunt and are Hunted," the following story is credited to Allan Brooks: "The Indians of the Frazer River valley tell a story of two men in one of their tribes who had a dispute as to how the whistler made the noise, one claiming that it was produced by the wings, the other, that it was vocal or made through the nostrils. Others joined in the dispute which resulted in the death of the majority of the warriors, leaving the question unsettled."

DESCRIPTION. "Adult male. Head greenish; circular white patch at base of bill. Female. Head and throat brown; breast and back gray; a white throat ring; belly and speculum white."

Barrows' golden eye (*Clangula islandica*). This bird is by no means common here, though specimens have been taken and mounted.

DESCRIPTION. "Adult male. Head purplish blue; white patch at base of bill twice as high as wide. Female. Same as the American golden eye."

The buffle head (*Charitonella albeola*) is one of our local tree breeders, and has, in common with others of its class, suffered from spring shooting and pickerel.

DESCRIPTION. "Adult male. Head blue, purple and green; a white band from eye to eye across the nape. Female. A whitish patch on either side of the head; throat and upper parts grayish brown; belly and speculum white."

The ruddy duck (*Erismatura rubida*) is one of our most common species. It breeds in the marshes along the bays of the St. Lawrence, among the islands, and also on the shores of our inland lakes. This duck is a veritable gormand, and is

known locally as the "butter ball," and by some as the "deaf duck," though why, it is not so easy to see, as it never shows any signs of defective hearing, as many a hunter can readily testify.

DESCRIPTION. "*Adult male*. Cheeks white; cap black; back reddish brown; tail feathers narrow and stiff; bill short. *Female*. A whitish streak through dusty cheeks; back grayish brown, with fine buffy bars; belly silvery whitish."

The "old squaw" (*Clangula hyemalis*) is plentiful throughout the St. Lawrence and lake region, large numbers wintering on Lake Ontario. Locally it is known to our Canadian neighbors as the "cock-a-wee," and the local names of "John Conolly" and "John Hollenbeck" are common. When a boy the writer was taught to call this bird the "south, south southerly," words which its cry closely imitated.

DESCRIPTION. "*Adult male*. Central tail feathers much lengthened; in winter, crown, nape, throat and neck all around white; in summer, black with rusty markings on back. *Female*. In winter, cheeks, neck all around and under parts white; breast and sides of neck dusty. In summer, crown, cheeks and nape blackish; throat and breast dusky; a whitish patch back of eye."

The harlequin (*Histrionicus histrionicus*) has been taken here, but it is very scarce.

DESCRIPTION. "*Adult male*. Back and breast slaty blue; head darker. *Female*. Front half of cheeks and spot over ears whitish; above blackish brown; below dusky and whitish."

The American eider (*Somateria dresseri*) is the only individual of that species ever found here. It is not numerous at any time, though several are taken every autumn. It comes to us very late, and its stay is limited to two or three weeks at the most.

DESCRIPTION. "*Adult male*. Crown black with a white wedge. *Female*. Brownish black above, margined with rusty and buff; below dusky finely margined with buff; bare spaces on either side of feathers of culmen rounded at the base (posteriorly)."

The American scoter (*Oidemia americana*) is common enough in this locality, though no hunter will go out of his way to kill one. They are exceedingly poor eating, their flesh being very strong and fishy, so much so that to eat one in Lent would hardly violate any church rule. Locally they are known as "niggers" and "ironclads."

DESCRIPTION. "*Adult male*. Wholly black; bill black, yellow at base. *Female*. Brownish above, lighter below; no white on wings or sides of the head."

The white-winged scoter (*Oidemia deglandi*) is also found here, but for the same reason it is in no greater demand as a table bird than its relative, the American scoter.



COOT (OR MUD-HEN) AND NEST.

J. E. STANLEY, PHOTO.



DESCRIPTION. "*Adult male.* Black, a white spot about the eye; bill orange, black at base. *Female.* Dusky brown above; lighter below." This species has also "a white patch on the wing; feathers extending forward along the sides and top of the bill nearly to the nostrils."

Geese.

Order *Anseres*. Family *Anatidae*.

Of these, there is but a single species that may be said to frequent the St. Lawrence river, or the islands and bays at the foot of Lake Ontario; it is the Hutchins goose (*Canadensis hutchinsii*).

This species is smaller than the common wild goose (*Branta canadensis*), but it is marked almost identically the same, and hence I do not deem it necessary to append a description.

Occasionally a specimen of the common brant (*Branta bernicla*) is taken here, but they are by no means common. They are highly esteemed for table use, but it is very seldom that the hunter is enabled to gratify his palate with a taste of this delicious goose.

Shore Birds (*Limicolae*).

Of this order, two families, snipes (*Scolopacidae*) and plovers (*Charadriidae*) with a single individual of the *Aprizidae*, the turnstone, are all that are represented in this region. In mentioning each individual species I have condensed its description as much as possible, confining it to adults entirely. With this explanation, the reader will have no difficulty in the application. Because of their brevity, I have borrowed the descriptions from Chapman's "Color Key to North American Birds"

The shore birds closely follow the geese and ducks in their northward migration, their stay here being very short. Some of them breed here, and now that the law has designated a close season for them, it is hoped that their numbers will increase. They return from the north late in the summer, but are rarely disturbed now by our local sportsmen, nor are they sufficiently numerous to attract the professional or the "market hog." I am told by old-time sportsmen that in the early days of snipe and plover shooting in the St. Lawrence River region it was not an uncommon thing to bag a hundred Wilson plover in a day on the shore of any one of our inland lakes, and that it was no difficult matter to take half as many woodcock in the same time.

The day of such sport here is passed; though it is hoped that conditions may improve to some extent, even though environments are less favorable to our wild fowl.

PLOVERS (*Charadriidae*).

There are five species of the plover family, two at least, and probably three, of which breed here.

The American golden plover (*Charadrius dominicus*) is one of the most common, following close after the snipe in the spring. In this region they may be looked for early in May; and by the last of that month they have left us for their breeding grounds in the far north.

They return to us, as a rule, in September, often in quite large flocks, but are rarely disturbed now by our local gunners, who usually have "something to do," as one expressed it, "besides hunting jack snipe." Sportsmen who come here at the proper time in the fall usually meet with good success, unless they are expecting to secure large numbers. In such cases they are likely to be disappointed; while he whose desires are moderate is quite likely to enjoy a fair modicum of sport.

MARKINGS. "Above, conspicuously spotted with yellow, below, black; sides of breast white; no hind toe; axillars dusky."

The bartramian sandpiper (*Bartramia longicauda*), also known locally as the "upland plover," is a home breeder, and is found more especially on the higher points and ridges at the foot of Lake Ontario, and around our inland lakes. Though very difficult to capture, it is much sought after by sportsmen. This bird is decidedly musical, its song being a long, sweet, melodious whistle.

Though strictly a sandpiper, I have placed this bird among the plovers, because to the sportsman it is the upland plover, and is likely to remain so. While to the local dweller it is sometimes known by some other name, the upland plover is its prevailing designation. Then, too, its habits are not those of the sandpiper, as it does not frequent either our inland lakes, ponds or rivers; nor does its flesh have the fishy taste so often found in other sandpipers, because its food is chiefly insects. As a table bird it is considered among the very best by those well qualified to judge. I am sorry to say, however, that the sportsman who expects to bag many of these birds in a day's shooting in this region will be sadly disappointed. First, they are very scarce, and, second, they are very shy and hard to get.

MARKINGS. "Outer primary barred black and white; above black, ochraceous, and brownish gray, breast and sides with dusky arrowheads, throat and belly whitish."



J. E. STANLEY, PHOTO.

LEAST BITTERN AND NEST.



The black-bellied plover (*Charadrius squatarola*), known also as the "lapwing" or "Swiss plover," is a frequenter here, arriving at the same time with the golden plover, on its way north, returning usually in September. They are by no means numerous in this region at any time; but when found it is usually about the sandy shores of our inland lakes, and on similar shores around the islands in the St. Lawrence.

MARKINGS. "Hind toe present but small; above, black and white, no yellowish; below, black."

The Wilson plover (*Ochthrodromus wilsonius*) is found here, one of its best-known local breeding places being along the shores of Mud Creek in the town of Cape Vincent, though it no doubt breeds at numerous other places near the river.

MARKINGS. "No black on hind neck. One black breast, and crown band; some rusty about the head."

Though not common, the turnstone (*Arenaria interpres*), known also as the "red-legged plover," is frequently seen and sometimes killed, but not often.

The ring-tailed marlin (*Limosa fedoa*) is occasionally taken here.

The dowitcher (*Macrorhamphus griseus*) is occasionally taken. This bird is also known as the "red-breasted snipe" and by some hunters who come here the "New York godwit."

MARKINGS. "Rump, tail under wing coverts and axillars barred black and white; above, black margined with rusty; rump white; below, reddish brown spotted and barred with black."

Wilson snipe (*Gallinago delicata*) breeds here in abundance, and is much sought after by our sportsmen. Many of our local hunters call this the "jack snipe." In fact, jack snipe is really the only name one hears for this species, unless it may be just "snipe." It usually arrives here when the ice is leaving the river. A few nest here; but when the weather begins to grow warm they nearly all take their flight northward, breeding beyond the northmost boundary of the United States. The snipe bores in the mud and soft earth for its food, and the hunter, if he sees no evidences of boring for worms, may be sure that there have been neither snipe nor woodcock ahead of him.

There is seemingly nothing more uncertain than the arrival and departure of this bird. Usually they arrive from the north the last of September; but no matter how soon a sharp frost occurs they are away as suddenly as they came, leaving scarcely a straggler behind.

Huntington gives one reason for the disappearance of snipe from many localities, which I am inclined to think is in a great degree applicable to this region. He

says: "There is a reason for the absolute disappearance of these birds from many places, to be found in the draining of the lands."

From the fact that their feeding grounds are low meadows and bog lands, easily bored for worms, it is evident that drainage would destroy them for feeding purposes, and therefore they are driven to other haunts for subsistence. I have known snipe to bore into the fresh-turned earth where the great breaking plow with its two yoke of oxen had made deep furrows through a boggy swale. While the plowmen were at dinner up at the house, scores of snipe were gathering luscious earthworms from the newly turned black soil of the bog down in the field. There is good reason to suppose that with some additional protection snipe may become much more numerous than now.

MARKINGS. "Throat and belly white or whitish; breast rusty buff indistinctly streaked; sides barred; above, streaked black and cream buff; tail black and rusty; outer feathers barred black and white."

THE WOODCOCK (*Philohela minor*).

This bird easily takes first place among the waders. Because what he has said of this bird is so well said, I have taken the liberty of quoting largely from Mr. Dwight W. Huntington's admirable chapter devoted to the woodcock. He says: "No American game bird is more highly prized by shooters than the woodcock. Dr. Coues observes: 'This is *the* game bird after all, say what you please of snipe, quail or goose;' and Gurdon Trumbull adds, 'Yes, Doctor, either in the field or on toast.'"

It is easily distinguished from the other game birds. "The general color is a rufous gray, effectively marked above with black; its head is larger than that of the snipe or partridge (bob white), and its eyes are set well back and high to enable it to see when boring in the mud with its long bill. The legs and bill are of a gray flesh color; the bill is about two and three quarter inches long; twice the length of the head." In extent of wings the woodcock will measure about eighteen inches, and a full grown bird will weigh from seven and one half to ten ounces according to its condition.

While the general haunt of the woodcock is boggy and low-lying woodland, he is often found in the hillside forests, and not infrequently at the summit of the hill.

The woodcock arrives on the St. Lawrence River usually about the first of April, and many breed in its vicinity. In some places, however, where only a few years ago they were numerous there is scarcely one to be found. There is a



J. E. STANLEY, PHOTO.

PIED-BILLED GREBE AND NEST WITH YOUNG BIRDS.



strip of woodland in the town of Cape Vincent, Jefferson county, where, Mr. Stanley tells me, a pair of woodcock have bred for several years.

His explanation of the scarcity of woodcock is, first, the "game hog" hunter who used to frequent this section as long as there was anything left to shoot; and now, the robbing of their nests by vermin and the destruction of their young by hawks and other predatory fowl. Not long since Mr. Stanley shot a large hawk just as it had eaten about half the flesh from a partridge. On another occasion while preparing a night hawk for setting up he found in its crop a couple of young yellow legs, so that he is convinced that similar depredations on the young woodcock are one of the causes that prevents a more rapid increase of this very desirable bird.

Their food is principally earthworms, though insects, common in damp and spongy woods, are readily devoured. It is said that a woodcock will devour more than its weight of worms in a single night. It has certainly been demonstrated by actual experiment that it is a gormandizer of no mean capacity.

Bearing in mind the many obstacles which prevent the increase of this fowl, it seems to me that the law should lend its aid to any reasonable extent necessary to prevent its total extermination. The present law says: "Woodcock shall not be taken from December first to September fifteenth, both inclusive. No person shall take more than thirty-six woodcock in an open season."

The length of the close season is not so objectionable, though it would have been better had it been a month longer. I would move to amend the law, however, by striking out the word "thirty" in the compound "thirty-six," as the least the Legislature ought to do.

If, however, our lawmakers were disposed to really do what ought to be done, I would move to amend by striking out all but the enacting clause and substituting: Woodcock shall not be taken, killed, had in possession, nor sold within the State nor carried without the State for a period of ten years after the passage of this act, under a penalty of one hundred dollars for each and every offense upon conviction thereof. Upon conviction the second time for either of the above offenses, a fine of two hundred dollars and an imprisonment at hard labor for one year, or both, at the discretion of the court. This act to take effect immediately.

From the fact that none of them are sufficiently numerous at any time to attract attention, or to offer any great inducement to the hunter, I have made only a brief allusion to the remaining shore birds which are found throughout this region in greater or less numbers, in proportion to their facilities for obtaining food, or for breeding unmolested.

With regard to cranes, rails, gallinules, etc., the Paludicolae, I have followed the same plan, and for a similar reason I have indulged, also, in but little more than brief mention of the bitterns, loons, grebes, gulls and terns.

It seems quite probable that under proper protection our shore birds will increase to a considerable extent in some of the more sparsely settled localities—sufficiently so, at least, to afford the sportsman of moderate desires a fair bag in a day's shooting.

The greater yellow legs (*Totanus melanoleucus*) is abundant in every part of the St. Lawrence region, and so is its congener "yellow legs" (*Totanus flavipes*), the latter being smaller in size.

MARKINGS. "No rusty; upper tail coverts mostly white; tail barred with black and white or gray; above, black margined with whitish; below, white and black."

The long-billed curlew (*Numenius longirostris*) is common here, and so also is the Hudsonian curlew (*Numenius hudsonicus*). Both species are plenty in their season, every marsh having its contingent. Occasionally, a specimen of the Eskimo curlew (*Numenius borealis*) is taken, but not often.

The killdeer (*Oxyechus vociferus*) is too common the country over and too well known to make a written description at all necessary.

The sand-hill crane (*Grus mexicana*) is common to the entire St. Lawrence valley.

The king rail (*Rallus elegans*) abounds here, together with the Carolina rail (*Porzana carolina*).

The Florida gallinule (*Gallinula galeata*), known also as the "American gallinule," is a frequenter of the entire Thousand Island region. By some of our sportsmen this species is known as the "water chicken," and by others, as the "water rail." The most common local name, however, for this bird is the "mud hen."

Occasionally, a specimen of the pomarine jaeger (*Stercorarius pomarius*) is taken in this locality, but not often. Mr. James E. Stanley has a very fine specimen in his collection.

The American coot (*Fulica americana*) is common all along the St. Lawrence river.

BITTERNS.

Two of the bittern family are common to our swamps and marshes—the American bittern (*Botaurus lentiginosus*), locally called a "schytopoke," and the least bittern (*Ardetta exilis*).



J. E. STANLEY, PHOTO.

PIED-BILLED GREBE WATCHING ITS NEST.



J. E. STANLEY, PHOTO.

A LOON ON ITS NEST.



LOONS (*Gaviidae*).

Two species of the loon family are found in this vicinity—the loon (*Gavia imber*) and the black-throated loon (*Gavia arcticus*). The latter species is very like the former in its markings, but is a smaller bird. The loon is one of the commonest sights to the traveler on the St. Lawrence, and to amateur sportsmen a source of never-ending interest because of the difficulty in securing a specimen.

GREBES (*Podicipidae*).

The pied-billed grebe (*Podilymbus podiceps*) breeds readily in the marshes and is very common especially along the upper St. Lawrence. This bird is locally known as the “hell-diver.”

The horned grebe (*Colymbus auritus*), known also as the “hooded grebe,” is also a home breeder, but is less common than the pied-billed grebe.

GULLS AND TERNS (*Laridae*).

The American herring gull (*Larus argentatus*) breeds throughout the St. Lawrence region, and is common to both river and lake.

The laughing gull (*Larus atricilla*) is often seen and oftener heard; but it is by no means as numerous as the species just mentioned. The same may be said of the Bonaparte gull (*Larus philadelphia*). Neither of these is known to breed in this vicinity.

The common tern (*Sterna hirundo*) breeds in our marshes and is very common during the season. This is the case, also, with the black tern (*Hydrochelidon nigra surinamensis*).

The kittiwake (*Rissa tridactyla*) and the Iceland gull (*Larus leucopterus*) are numerous during the summer and autumn.

There was a time here when the gulls and terns were shot in large numbers, their plumage being in great demand for millinery decoration; but of late these birds remain practically undisturbed.

It is quite likely that in this article I have omitted some names which should have been inserted in order to make the list more complete. If so, I have left something to be supplied by some one who will write for the next report. I can only say that I have done the best I could under the circumstances. My chief regret lies in the fact that I am not better qualified to do full justice to a subject of so much interest.

As an appropriate ending to this article I append the following letter, which speaks for itself. The writer's opportunities for gathering facts, and his well-known habit of close observation, especially upon a matter in which he takes so much interest, give great weight to his statements and cannot fail to interest the reader.

WATERTOWN, N. Y., *March 17, 1905.*

FRIEND DURHAM:—Your inquiry regarding the breeding of wild fowl in this county is one that interests me very much. From reports that have come to me, as president of the Sportsmen's Association, and from my own personal observation, the results of stopping spring shooting in Jefferson County have far exceeded the expectations of its most ardent supporters.

The wood duck and the blue-wing teal are nesting here in larger numbers each year. These birds are the first to leave us in the fall; and since the opening season was extended to September fifteenth very few of them have been killed, which may account for your belief that they do not nest here to any great extent.

The increase of the black duck, or dusky mallard, has been marvelous, reports showing that it nests in all sections of the county and in places where it was never known to nest before. Not only have the marsh ducks nested here, but the divers also—but to a lesser extent. I have undoubted proof that the whistler, shelldrake, broad-bill, red-head, in fact nearly every known duck which frequents our waters, have remained and nested, and also the English snipe.

I would suggest a limit of twenty-five ducks to one gun for one day; that the season open September first instead of September fifteenth; a better enforcement of the game law during the summer on the lake and the St. Lawrence Reservation both as to the size and limit of black bass, and the wanton slaughter of unpledged wild fowl by visiting sportsmen.

Very truly yours,

W. H. TALLOTT,

President Jefferson County Sportsmen's Association.

I desire to call especial attention to the half-tone illustrations, from photographs by J. E. Stanley, Jr., of Cape Vincent, N. Y., some of which were achieved under difficulties which no one but an enthusiast like himself would have overcome. The pictures themselves show that they could not have been easily obtained, and are, therefore, of necessity, rare and consequently valuable. Some of these pictures have taken valuable prizes in contests where photographs of a similar character were exhibited.

A Forest Working Plan

For

Townships 5, 6 and 41,

Totten and Crossfield Purchase,
Hamilton County,

New York State Forest Preserve.

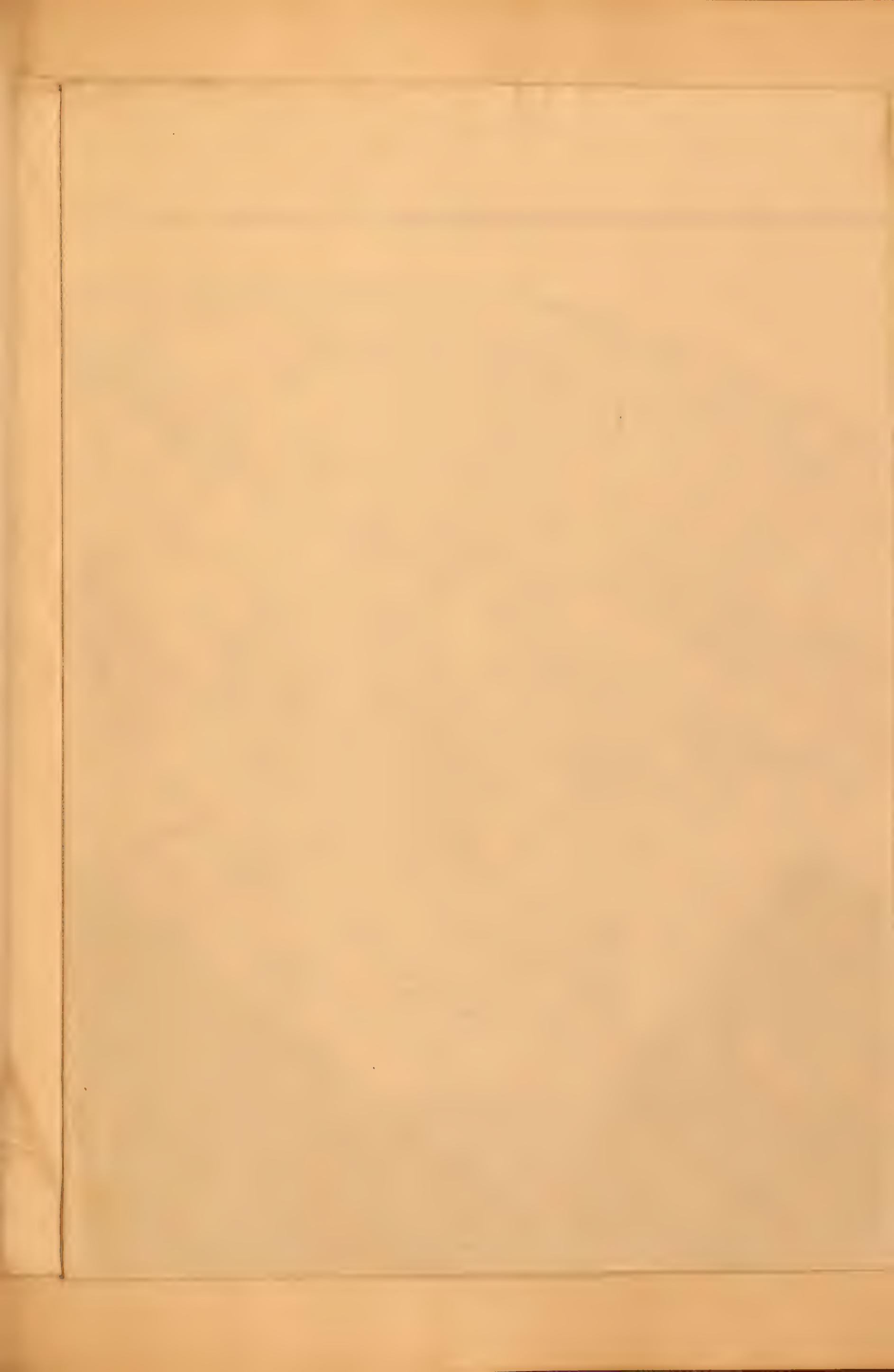
By

Ralph S. Mosmer, Field Assistant, and

Eugene S. Bruce, Lumberman,

Bureau of Forestry, United States Department of Agriculture.





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A Forest Working Plan

For Townships 5, 6 and 41, Totten and Crossfield Purchase,
Hamilton County, New York.

PART I.

Introduction.

THE object of this report is to present a definite and comprehensive plan by which a certain part of the Adirondack Forest Preserve in New York may be managed in accordance with the principles of practical forestry. It sets forth the methods which should be followed in removing the timber now merchantable, in order that repeated crops may be harvested and the general productive condition of the forest not only maintained but improved.

This working plan is the result of a continuation of the work carried on in the Adirondack Forest Preserve by the Bureau of Forestry during the summer of 1900, in response to a request made by the Forest, Fish and Game Commission of New York to the United States Department of Agriculture for cooperation in the study of the Adirondack Forest Preserve. In accordance with that request, which followed an appropriation from the Legislature, a forest working plan was prepared for Township 40, Totten and Crossfield Purchase. This was published during the spring of 1901 as a bulletin of the Bureau of Forestry.*

In order that the study begun on Township 40 might be extended, the Legislature of 1901 voted an appropriation of \$3,500, through the means of which, and in accordance with the terms contained in Circular 21 of the Bureau of Forestry, this working plan for Townships 5, 6, and 41 was made.

These three townships, together with Township 40, containing, in all, nearly 100,000 acres, form one of the largest and most compact blocks of State land within the proposed Adirondack Park. The forest problems presented on all four townships are the same, and when taken together these townships form a better unit for economical administration than if managed separately.

Therefore the present working plan must be considered as a supplement to that for Township 40, in which may be found facts and figures relating to the

* Bulletin No. 30, "A Forest Working Plan for Township 40," by Ralph S. Hosmer and Eugene S. Bruce, Washington, D. C., 1901.

three other townships of the block, together with recommendations for forest management within them.

For this, and for the further reason that it has been found advisable in a number of cases to discuss the problems presented without reference to township lines, there are frequent references in the following pages to Township 40. Especially is this the case in regard to certain watersheds, parts of which are in more than one of the four townships. This working plan for Townships 5, 6, and 41, however, can stand alone, although in the actual working out of the problems presented on the whole block it would undoubtedly be used in close conjunction with that for Township 40.

General Description of the Block.

Townships 5, 6, 40, and 41 form a roughly rectangular block on the western side of Hamilton County in the west-central section of the Adirondack Park. The county line between Hamilton and Herkimer counties cuts off the northwest corner of Township 41, which is the only part of this township not owned by the State. Townships 40 and 41, with the exception just noted, are situated wholly in the town of Long Lake. Township 5 lies partly in the town of Morehouse and partly in Arietta, while Township 6 is also in two towns, Arietta and Lake Pleasant, the southeast corner of Township 6 lying in the latter.*

The lines of Townships 5, 6, and 41, like those of Township 40, run N. 63° E. and N. 27° W., the former being referred to as north and south lines, the latter as the east and west. The lines of Townships 6 and 40 are approximately 6½ by 6 miles in length, while those of Townships 5 and 41 are 7½ by 5½, the longer distances in each case being the east and west lines.

AREA.

The area of Townships 5, 6, and 41, including private holdings, is as follows:

	Acres.
Township 5	23,106
Township 6	26,619
Township 41	23,117
Total	<u>72,842</u>

This area together with that of Township 40—25,660 acres—gives a total for the four townships of 98,502 acres.

*It may be noted that the township in the Adirondacks is distinct from the town. The township refers solely to the subdivision of the land as originally allotted, while the towns are the political divisions. A town may consist of a number of townships or parts of townships.

TOPOGRAPHY.

The block is characterized by generally broken topography. Long ridges, trending generally east and west, extend partly or entirely across each of the townships, making, with the lesser hills, a number of watersheds.

The slopes of the ridges are usually steep—in some places precipitous. They are for the most part covered with forest, although on a few of the exposed and wind-swept summits the vegetation is reduced to shrubby growth or gives place to bare rocks.

Many of the broader valleys contain ponds, which are gradually being transformed into swampy land by the growth of moss and other vegetation. This development is illustrated by the open pond, the one in which the sphagnum moss has begun to encroach, the quaking bog, the haymarsh, with its fringe of tamaracks, and the swamp, thickly studded with balsams.

ROCK AND SOIL.

The prevailing rock on these townships is granitic in character. It is overlaid more or less deeply by a covering of glacial drift and in the swamps and low valleys by alluvial deposits. Throughout the forest there is a fairly deep layer of humus. The mineral soil, when exposed, is usually a sandy gravel.

THE WATERSHEDS.

The streams draining the three townships form parts of four important drainage systems: The Raquette River, the Moose River, the Fulton Chain and the Cedar River.

The extreme northeastern corner of Township 41 is tributary to the Shingle Shanty Brook on Township 39, a stream belonging to the Beaver River watershed. Only a small area is so inclined, and from this the timber could easily be hauled back into the Big Moose watershed. It will not therefore be considered further.

RAQUETTE RIVER SYSTEM.—The Raquette River System is the most important on the block. In it are included all the streams tributary to Raquette Lake, which is, in turn, drained by the Raquette River, flowing north into the St. Lawrence. There are five principal streams in this system on Townships 5, 6, and 41.

The most important of these is South Inlet. This empties into South Bay of Raquette Lake, draining a good share of Township 6 and part of Township 5.

Mohegan Lake also flows into South Inlet, as do a number of small streams from the hills in the central part of Township 5.

Next in importance is Sucker Brook, which gives the name to the large bay in the northern part of Raquette Lake. This stream drains Shallow and Queer Lakes, Pelcher Pond, and the Haymarsh Ponds, all on Township 41. Its watershed covers all the southern third of that township.

Another stream is the Brown's Tract Inlet, emptying into Raquette Lake at its western end. This drains parts of Townships 5 and 41 and receives the waters from the Brown's Tract Ponds and the streams flowing into them.

The fourth stream is Beaver Brook, flowing into Beaver Bay and draining the small valley in the southeastern part of Township 41, much of which is open marsh.

The remaining stream is the Bear Pond Brook on Township 6, which flows into the Marion River at a point on the Utowana Carry.

MOOSE RIVER SYSTEM.—The second principal drainage area is the Moose River System. This includes the chain of lakes making the North Branch of the Moose River and composed of First and Second Lakes—now called respectively Lake Rondaxe and Dart's Lake—and Big Moose Lake. The water from Constable Pond, with its tributaries, Chubb and Pigeon Ponds, empties into the South Bay of Big Moose; Russian Lake into East Bay; while into Inlet Bay flow the most important brooks draining the northern part of the township. The characteristic features of the valleys of each of these streams are the balsam swamps through which they flow, and the steep hills on either side of the U-shaped valleys.

THE FULTON CHAIN.—The greater part of the Fulton Chain watershed on the block is on Township 5, which contains the upper part of Seventh and the whole of Eighth Lake. The tributary brooks are short and usually nameless, with the exception of the Seventh Lake Inlet, which drains a valley of considerable size in the center of the township. To this watershed also belong Eagle Creek (a small brook in the southwest corner of Township 41 flowing into Fourth Lake) and the stream draining the little valley just north of Black Bear Mountain and lying partly in Township 5 and partly in Township 41. This brook also flows into Fourth Lake.

The streams tributary to the South Branch of Moose River are in the southwest corners of Townships 5 and 6. They are Red River; Benedict Creek, which drains Bear Pond on the Nivins Lot; Sumner Stream, the outlet of Lake Kora; and the North Branch of Silver Run, draining the valley lying between Bradley and Wakeley Mountains.

CEDAR RIVER SYSTEM.—The remaining system is represented by a small brook in the extreme southeast corner of Township 6, which flows into Cedar River, a branch of the Hudson. This section has been cut over and is of relatively small importance, but is interesting as belonging to the Hudson River Drainage Basin.

Following is a brief description of each of the three townships:

TOWNSHIP 5.

Township 5 is bounded on the north by Townships 41 and 40; on the east by Townships 6 and 4; and on the south and west by Township 4, Totten and Crossfield Purchase, and Townships 3 and 4 of the Moose River Tract.

In common with the remainder of the block the topography of Township 5 is mountainous. There are several ranges of hills without continuous ridges as on the other townships, but broken up into irregular groups. The summits of a number of these hills have elevations of over 2,200 feet. The highest point on the township is 2,580 feet.

In the northern third of Township 5 lie Eighth Lake, a portion of Seventh Lake, and the Brown's Tract Ponds, a scarcely perceptible divide separating the two watersheds. The drainage from the high ridges in the center of the township, and from the southeastern part, is mainly through brooks flowing into the South Bay of Raquette Lake, while the water from the southwestern corner is carried to the South Branch of the Moose River through several streams.

TOWNSHIP 6.

Township 6 lies to the southeast of Township 40 and is further bounded by Townships 34, 33, 7, 4 and 5, all of the Totten and Crossfield Purchase. It is approximately of the same size as Township 40, the boundary lines being six and one half by six miles in length. The dominant features in the topography are the hills of irregular shape in the northern half of the township and the much higher ridges within and bordering its south edge. The highest point in the township is the summit of the Blue Ridge, which reaches an elevation of 3,460 feet.

The water on Township 6 goes into each of the three principal watersheds. The largest area is that tributary to the South Bay of Raquette Lake. Its main stream is South Inlet. The rest of the water finding its way into South Bay flows through Death Brook which drains the northern side of the hills facing Raquette Lake.

Another and smaller area is tributary to the South Branch of the Moose River into which flows Sumner Stream, which drains Lake Kora and the country immediately adjacent thereto, and the North Branch of Silver Run which flows from the high valley lying between the ridges of Bradley and Wakeley Mountains in the extreme southwestern corner of the township.

A third area in the southeastern corner of the township is drained by a stream which finds its way into the Cedar River and eventually into the Hudson. The portion of Township 6 lying in this watershed was cut over some twenty years ago in connection with lumbering then in progress on Township 7.

TOWNSHIP 41.

Township 41 is the most westerly of the block made up of Townships 5, 6, 40 and 41. It is bounded on the north and east by Townships 42, 39 and 40; on the south by Township 5 (all in the Totten and Crossfield Purchase), and on the west by Township 8, in the John Brown's Tract. The Herkimer-Hamilton County line crosses the northwest corner of this township.

In topography Township 41 is decidedly mountainous. The northern part is characterized by long, high ridges traversing the township from east to west and alternating with U-shaped valleys through which flow the brooks, many of them bordered with balsam swamp. The streams in this half of the township are tributary to Big Moose Lake. The largest of them drains the Twin Sisters Ponds and South Pond on Township 39, emptying into Inlet Bay at the northeast end of Big Moose Lake. It is navigable by guide boats for a short distance only above its mouth, but a good trail follows it across the township. Toward the western side of the township are a number of ponds which lie among the hills. These also are all tributary to Big Moose Lake.

In the south half of the township is a fairly broad valley containing Shallow Lake, Pelcher Pond, and Queer Lake. This water is all tributary to Raquette Lake and flows into it through Sucker Brook. Only short stretches of this stream are navigable by guide boats.

There are also three other minor watersheds in the south part of Township 41. Beaver Brook, which flows into Raquette Lake; a small part of the Lower Brown's Tract Pond, also tributary to Raquette Lake through the Brown's Tract Inlet; and Eagle Creek, in the southwest corner. This stream flows into Fourth Lake, but all the timber on its watershed could easily be brought back into the Brown's Tract Valley.

Land Classification.

The total area of each of the three townships is divided into several classes of land—the merchantable area, consisting of the spruce land and the swamp types combined, the water front and the summit reserves, the burned-over land, and the private holdings. In the following table is given the acreage of each of the several classes of land in each of the three townships:

TABLE IV.—AREAS—TOWNSHIPS 5, 6, and 41.
Reserves, Merchantable Area.

TOWNSHIP.	Burned-over land.	Water front.	Summit.	Spruce land.	Swamp.	Total.	Private holdings.	Total, township.
No.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
5	963	1,758	397	12,691	4,462	17,153	2,835	23,106
6	14	986	1,411	15,298	6,164	21,462	2,746	26,619
41	26	1,962	1,270	14,206	5,653	19,859	. . .	23,117
	1,003	4,706	3,078	42,195	16,279	58,474	5,581	72,842

The Forest.

GENERAL DESCRIPTION.

The forest on the three townships is of the general spruce and hardwood type common to the Adirondack region. While similar to that on Township 40, the forest on each of the other three townships in the block possesses certain individual characteristics, due mainly to the topography.

Red spruce is everywhere the commercially important tree. In mixture with it are found balsam, hemlock, arborvitae, white cedar, yellow birch, sugar maple, and beech, together with scattering individuals of other valuable species, the most important of which are white pine and black cherry. As is the case on Township 40, the forest on these townships has, with the exception of a few very limited areas, never been cut over. Together the four townships form the best continuous body of existing original forest in the Forest Preserve, if not in the whole Adirondack region.

FOREST TYPES.

Four types of forest were distinguished—spruce land, swamp, upper spruce slope, and pine land. The spruce land and swamp types are commercially the

important ones. The upper spruce slope type embraces the higher portions of the hills and ridges and no lumbering was recommended for it, the land being set apart as "Summit Reserve," and so named upon the map. The pine land type is small in area and is found only upon Township 5, but is important as an additional asset to be obtained from the township.

SPRUCE LAND.—The spruce land type covers the well-drained portions of three townships, embracing practically all the land above the swamp except the tops of the higher hills, which, as stated, are set apart as summit reserves. Spruce land is characterized by a mixed forest of spruce and hardwoods. The predominant trees are red spruce, yellow birch, sugar maple, beech, balsam and hemlock, with a scattering of ash, black cherry, basswood and elm, and, on the lower portions, occasionally a white pine.

Spruce land is commercially the most important type, forming about seventy per cent of the merchantable area in each of the three townships. On some of the slopes, especially in Township 41, are stands of pure spruce of large size and excellent quality. The most favorable situation for this species seems to be a southwestern slope of moderate steepness. The greater part of the balsam on the spruce land type is found on the lower part of the slopes near the streams, while the hardwoods do best midway on the slopes of the higher ridges or on the well-drained, rolling land near the lakes. On the higher slopes more exposed to the wind the spruce differs somewhat from that at lower levels. The trees are shorter and the limbs farther down the trunk, rendering them of less commercial value than those from which long, straight, clear boles can be obtained.

The forest floor over the greater part of the spruce land type is covered by a fairly deep layer of humus. On the surface of the ground is a covering of leaf litter and duff, above which in many places is an undergrowth of witch hobble and the two low maples—the striped maple or moose wood and the mountain or spotted maple.

The first growth to come in on the burned-over areas, most of which fall within the limits of spruce land, consists of the aspens, wild cherry, and paper birch. Under these trees the spruce and balsam spring up, eventually forming a pure stand of conifers, or, with the broadleaf trees, a mixed forest.

SWAMP.—The swamp type includes the low-lying land bordering many of the streams and some of the lakes. It differs from spruce land in the proportion of spruce in mixture with other trees. On the swamp the balsam plays a very important part in the mixture. Here also is found the greater part of the white pine.



A. KNECHTEL, PHOTO. 1903

LOWER SPRUCE SLOPE. MEDIUM STAND.



A. KNECHTEL, PHOTO. 1903

UPPER SPRUCE SLOPE. MEDIUM STAND.

Both the spruce and the pine do best in the swamp type on little hills or knolls rising above the general elevation of the typical swamp, but which are not large enough in area to be segregated from the remainder of the type. On such knolls are found also what little birch, sugar maple, and beech the type contains.

Taken as a whole the typical swamp conditions may be said to be characterized by the absence of birch, beech, and sugar maple, and the presence of large quantities of balsam growing on low-lying flats, with occasional knolls on which are found the spruce and pine. The other typical trees of the swamp type are the tamarack, the arborvitæ, and the red maple. Scattering white and black ash are also found on the better-drained portion.

UPPER SPRUCE SLOPE.—The third type, upper spruce slope, embraces the higher slopes of the mountains and principal hills. It has been set apart as one of the reserves and will be discussed in detail under that heading.

In the following is given a description of the forest upon each township.

TOWNSHIP 5.

The forest on Township 5 is a mixed one of conifers and broadleaf trees. Each of the three forest types is represented, but spruce land is the most important, covering 74 per cent of the merchantable area and 63 per cent of the total area.

On many small areas may be found good stands of spruce, but taken as a whole the number of trees per acre is not as large nor are the trees themselves of as good size as those on the other townships. The proportion of hardwoods, too, is greater. While there has been no organized lumbering on Township 5, a belt of spruce timber, to be used for bridges, fencing, etc., was cut across the township at the time of the construction of the Uncas Road. The removal of this timber, which was among the best on the township, makes the forest on Township 5 less valuable than that on the rest of the block.

The spruce land type on Township 5 contains large mixed stands of hardwoods and spruce in which the proportion of spruce is considerably less than the average for the whole township.

The swamp on Township 5 occurs mainly near the Brown's Tract Inlet in small bodies adjacent to Seventh and Eighth Lakes and in larger belts in the south part of the township. Here the stand is largely composed of balsam. This type covers twenty-six per cent of the merchantable area and twenty-two per cent of the total area of the township.

The upper spruce slope of summit reserve on Township 5 is smaller in area than

on either of the other townships, making only two per cent of the total area. It occurs on the crest of the high hills where several summits have been reserved.

There is an area lying in the watershed of Benedict Creek in the southwestern corner of Township 5 on which there is a considerable stand of original white pine. It is the northern extension of a large pine forest which formerly covered the upper part of the valley of the South Branch of Moose River. This type includes portions of both the spruce land and the swamp types, although most of it lies within the limits of the swamp. For the purpose of estimating this stand the portion of the township on which there were enough pine trees to constitute a merchantable quantity was set aside as pine land. The area is outlined on the accompanying map by a line made up of black crosses. This type covers 786 acres of State land and 211 acres of Lot 4 of the Nivins Tract.

TABLE I.—MERCHANTABLE STAND—TOWNSHIP 5.
Trees 10 inches and over in diameter breasthigh on 943 acres.

SPECIES.	Average number of trees per acre.	Percentage of each species.	Average diameter breasthigh.	Maximum diameter breasthigh.
			Inches.	Inches.
Spruce	24.37	33.09	13.6	32
Yellow birch	14.73	20.00	16.4	40
Beech	11.50	15.62	13.3	31
Sugar maple	7.17	9.74	14.9	40
Balsam	7.00	9.51	11.3	32
Hemlock	4.00	5.43	17.1	38
Soft maple	1.78	2.42	15.5	35
Cedar	1.59	2.16	13.4	31
Black ash . . . . .	.34	.46	13.3	28
White pine . . . . .	.23	.31	20.6	50
Dead spruce . . . . .	.22	.30	16.0	28
White ash . . . . .	.21	.29	3.5	28
Basswood . . . . .	.20	.27	16.7	34
Black cherry . . . . .	.18	.24	14.2	28
Aspen . . . . .	.05	.07	13.5	19
White birch . . . . .	.04	.05	12.1	28
Hornbeam . . . . .	.02	.03	11.0	13
Tamarack . . . . .	.01	.01	11.7	15
All species	73.64	100.00	14.4	

TOWNSHIP 6.

Township 6 is the only township in the block where any considerable portion of the forest has been lumbered. In the southeast corner is an area of some 2,700 acres lying in the watershed of the small stream tributary to Cedar River and shown on the accompanying map by a dotted black line. This was cut over about twenty years ago when the adjoining tract, Township 7, was lumbered. On this area there is now a fair stand of young spruce and balsam which will some day be of commercial importance.

Another cut-over area consists of about 180 acres tributary to the Marion River. The lumbering operations on both these tracts were carried on while the township was in private ownership.

The forest on Township 6 is better in character than that on Township 5. There is a larger proportion of spruce in the mixture than on either of the other townships, although the number of spruce trees per acre, ten inches and over in diameter breasthigh, is less than on Township 41. The broadleaf trees on Township 6 are also better in quality than are those on the other townships, which fact is of importance in view of the greater accessibility of a considerable portion of this township.

The spruce land type covers all the higher part of Township 6, constituting seventy-one per cent of the merchantable area and sixty-four per cent of the total area of the township.

The swamp on Township 6 lies mainly in the valley of the Shedd Lake Inlet, where the forest is made up of balsam, red spruce and black spruce. The balsam does not make as dense a stand in the swamp on Township 6 as it does on Township 41, and there are more open places. In addition to the areas just mentioned, there are small bodies of swamp in the vicinity of Bear and Slim Ponds and adjoining the open marsh near the Township 40 line. The swamp on Township 6 makes up twenty-nine per cent of the merchantable area and twenty-six per cent of the total area.

The upper spruce slope type on Township 6 includes six per cent of the total area of the township. Within its limits falls the ridge of Estelle Mountain, where all the crest has been set aside as a summit reserve. The boundary lines of this reserve have been drawn more with the idea of protecting the side of the mountain seen from South Bay than with reference to the contour lines, although most of the portion set aside lies above the 2,300-foot contour. The summit of the Blue Ridge forms another large portion of the reserve. The other bodies of

summit reserve in Township 6 embrace the summits of Bradley Mountain and of the several nameless hills scattered throughout the township.

The total number of valuation surveys run in the merchantable area in Township 6 was 1,240. The data compiled from these surveys appear in Table II.

TABLE II.—MERCHANTABLE STAND—TOWNSHIP 6.

Trees 10 inches and over in diameter breasthigh on 1,240 acres.

SPECIES.	Average number of trees per acre.	Percentage of each species.	Average diameter breasthigh.	Maximum diameter breasthigh.
			Inches.	Inches.
Spruce	26.82	44.43	13.7	31
Yellow birch	14.18	23.49	16.5	44
Balsam	7.88	13.07	12.5	26
Sugar maple	4.09	6.78	15.7	33
Beech	3.05	5.05	15.1	28
Hemlock	2.42	4.01	17.6	43
Soft maple	1.15	1.90	13.5	26
Cedar . . . . .	.23	.38	13.2	28
Dead spruce . . . . .	.23	.38	15.6	30
White pine . . . . .	.13	.22	24.2	33
Black cherry . . . . .	.08	.13	13.0	27
Black ash . . . . .	.05	.08	12.2	19
Tamarack . . . . .	.01	.02	12.3	18
Basswood . . . . .	.01	.02	13.5	17
White ash . . . . .	.01	.02	13.5	25
White elm . . . . .	.01	.02	13.5	25
Other hardwoods. . . . .	.01	.02	13.5	24
All species	60.36	100.00	15.6	. . .

TOWNSHIP 41.

The forest on Township 41 contains the three forest types. The spruce land type covers a greater proportion of the area than the swamp, making up sixty-one per cent of the total area and seventy-two per cent of the merchantable area. It embraces all the higher portions of the township lying between the upper limit of the swamp and the lower line of the summit reserve. The characteristic of this type is well-drained soil on which is found a mixed forest of



A. KNECHTEL, PHOTO. 1903

WHITE CEDAR.

BUG POND, TOWNSHIP 5, TOTTEN AND CROSSFIELD PURCHASE. TREES RANGING FROM FOURTEEN TO THIRTY-TWO INCHES IN DIAMETER, THREE FEET FROM THE GROUND.



A. KNECHTEL, PHOTO. 1903

HEMLOCK AND YELLOW BIRCH. BOTTOM LAND.

spruce and hardwoods. The best of the spruce on Township 41 occurs on the southwest slope of the long ridges, especially in the northern part of the township. On the hills in the center of the township the broadleaf trees are more in evidence, while on the lower slopes a larger percentage of balsam comes into the mixture. The stand of spruce on Township 41 is heavier than on either of the other townships or that on Township 40. On spruce land in Township 41 the spruce makes up nearly half of the forest, the percentage in mixture for trees ten inches and over being forty-one. Next in importance comes the yellow birch, followed closely by beech, the percentage in mixture of these species being respectively twenty and nineteen. Sugar maple, hemlock, and balsam, with a scattering of white pine, cedar and black cherry, make up the remainder of the forest.

The swamp type on Township 41 occurs mainly in the bottoms of the U-shaped valleys and on the lower slopes of the ridges, especially in the northern part of the township and on the low-lying land along the Sucker Brook. It makes twenty-eight per cent of the merchantable area and twenty-four per cent of the total area of the township. It is characterized in this township by the abundance of balsam, the stand of this species being in many cases pure and having a density so great that one can only with difficulty penetrate the thickets. The percentage in mixture of balsam is twenty-eight. There is forty per cent of spruce, the average number of trees per acre being twenty-three. Two areas of open marsh occur in the swamp type on Township 41; one of these surrounds Haymarsh Pond, the other is in the lower part of Sucker Brook valley.

Near the Haymarsh Ponds there is a fair stand of young tamarack which is spreading out into the open marsh. This species is a very intolerant tree which grows only where it can have every advantage of light. It has become characteristic of the swamp because of its ability to live in wet situations.

Upper spruce slope, or, as it appears on the map, the summit reserve, occurs along the tops of the ridges, for the most part above the 2,300-foot contour line, although there are instances where the reserve line comes as low as 2,200 feet and others where the spruce land runs up as high as 2,400 feet. It covers five and one half per cent of the total area of the township.

TABLE III.—MERCHANTABLE STAND—TOWNSHIP 41.
Trees 10 inches and over in diameter breasthigh on 929 acres.

SPECIES.	Average number of trees per acre.	Percentage of each species.	Average diameter breasthigh.	Maximum diameter breasthigh.
			Inches.	Inches.
Spruce	29.75	40.75	14.1	33
Yellow birch	14.47	19.82	14.7	46
Beech	11.19	15.33	13.8	28
Balsam	7.08	9.70	12.0	29
Sugar maple	4.94	6.77	14.3	31
Hemlock	2.91	3.99	16.2	43
Soft maple	1.57	2.15	13.5	27
Cedar . . . . .	.46	.63	12.6	25
Dead spruce . . . . .	.28	.38	16.1	31
White pine . . . . .	.21	.29	28.5	45
Black ash . . . . .	.05	.07	13.5	20
Tamarack . . . . .	.04	.05	11.4	16
Black cherry . . . . .	.02	.03	13.5	33
Other hardwoods. . . . .	.03	.04	14.8	22
All species	73.00	100.00	14.1	

The Reserves.

In accordance with the policy adopted on Township 40, certain areas have been set aside on Townships 5, 6 and 41 on which it is recommended that no lumbering be done. These reserves are of two sorts, the water front reserve and the summit reserve. The location and extent of these areas is shown on the accompanying map.

WATER FRONT RESERVE.

The water front reserve consists of a strip at least two hundred feet in width around all the lakes and ponds and bordering some of the main streams. The purpose of this reserve is to protect the belt of forest adjacent to the lakes, which adds so much to the attractiveness of this region. This strip has been carefully plotted on the map and is believed to be of sufficient width to shut out from the view of persons passing on the lake any sight of the lumbering in the woods.

SUMMIT RESERVE.

The summit reserve includes that portion of the hills and higher ridges which are prominent in the landscape, and which, if lumbered, might present an unsightly appearance.

The summit reserve was treated as a forest type and under the name of upper spruce slope has already been described for each township. The forest on this portion of the tract is of inferior quality. Because of its exposed situation the timber growing at this elevation is, for the most part, short and somewhat limby, as well as being inaccessible. While it is perfectly possible to remove the trees from these situations, the cost of lumbering such places very nearly covers the value to be received, so that as a business proposition there is no great objection to leaving them uncut, especially as by so doing another point, important on a forest preserve tract, the preservation of the beauty of the forest, is gained. For these reasons it is strongly advised that no lumbering be done on this type.

Fire.

Taken as a whole, the four townships of the block have been remarkably free from damage by fire.

Township 5 has suffered most, there having been in this township several fires covering considerable areas. The largest of these is in the Red River valley, where almost seven hundred acres were burned over about twenty years ago. This burn marks the eastern extension of a very large fire which occurred on the lower portion of the Red River and the South Branch of the Moose River.

Next in importance is the burned area on the carry between Seventh and Eighth Lakes, which is somewhat more recent than that on the Red River. There are, also, a few acres of burned land on the hill at the other end of Eighth Lake.

The most recent fire of importance on Township 5 was that which denuded the summit of Black Bear Mountain. This fire occurred during the autumn of 1899 and forms the subject of a part of the report of the Superintendent of Forests for the following year.*

Other burns on Township 5 are those on the shore of Seventh Lake adjoining Township 3, a smaller area bordering the Township 40 line, which, with two

* Preliminary Report to Fifth Annual Report of the Commissioners of the Fisheries, Game and Forest. Albany, N. Y., 1900. Pages 61, 68 and 69.

other little patches on the hill above, were started by construction gangs during the building of Raquette Lake Railway, and one more in the extreme southwestern part of the township, lying near the point where the town line between Arietta and Morehouse crosses the south line of the township. The total number of acres burned over on Township 5 is 963.2, which is 4.75 per cent of the total area of the township.

Township 6 has been the most fortunate, the only burned area of at all recent date on this township being the small patch on the northern slope of the Blue Ridge, which covers 14.4 acres. This burned area dates back some twenty to twenty-five years and is now growing up with a dense stand of young spruce, balsam, and paper birch. In the total area of the township the burned-over land is only 0.06 per cent.

In Township 41 only a few small areas have been burned over, the total amounting in all to less than 30 acres. The largest of these little patches covers one of the points jutting into Shallow Lake. The others are the small areas on the ridges south of Sucker Brook valley, and the still smaller one on the lower of the Twin Sisters Ponds. The total burned area in this township is 25.6 acres, which is 0.11 per cent of the total area of the township.

On Township 40 the burned-over land amounted to one per cent of the forested area.

With the exception of those near the Raquette Lake Railway and on Black Bear Mountain, none of the fires were of recent date, and most of the burned-over area is now growing up to a fairly dense stand of forest trees. In some cases only the preliminary stage of birch and poplar has been reached, but almost everywhere the spruce and balsam will in time work their way in under these species.

In this connection it may be noted that the locomotives on the Raquette Lake Railway are oil-burning. This is a distinct improvement, so far as the danger from forest fire is concerned, over the type commonly used on the railroads penetrating the Adirondack region. The reason why this type of locomotive is used on this road is that in granting the charter it was stipulated that the railroad be allowed to cross the lands of the Forest Preserve only on the condition that oil be used as fuel.

Private Preserves.

On the three townships now under consideration are a number of private preserves. The title to these lands was either held before the remainder of the townships became State property or was acquired in such a way as to be recognized by the State.

TOWNSHIP 5.

Township 5 contains three areas of private land. The largest is the tract containing Mohegan Lake, which is owned by Mr. J. Pierpont Morgan. This preserve contains 1,568 acres. In the southeastern part of Township 5 is a part of the Hon. Timothy L. Woodruff's preserve around Lake Kora. The portion lying in Township 5 contains 155 acres.

The other private holdings on Township 5, recognized by the State, are the narrow strip making the right of way along the Raquette Lake Railway, certain holdings along the shores of the Seventh Lake, which are included in the water front reserve, and Lot 4 of the Nivins Tract.

The southwest quarter of Township 5 was originally subdivided into five lots, which together with a similar subdivision in Township 4 constitute the Nivins Tract. Four of the lots in Township 5 now belong to the State. The title of the other lot, No. 4, still rests with private owners.

During the summer of 1901 there seemed to be good reason for believing that this lot would soon be acquired by the State, rounding out the State's holdings in this township. For this reason, although Lot No. 4 was still privately owned, an estimate of the standing timber on it was made, which is given in tables that follow later in this report.

TOWNSHIP 6.

Township 6 was acquired by the State in 1896 through purchase from Mr. W. W. Durant. When the property was turned over, certain portions of the township were reserved. These are the private preserve around Sagamore Lake, owned by Mr. A. G. Vanderbilt; the tract about Lake Kora, on which is "Kamp Kill Kare," owned by Mr. Timothy L. Woodruff, and two smaller lots, known respectively as the C. P. Huntington wood lot, and Lot No. 37, sometimes called the "Mill Lot." These are the only lands on the township of which the State recognizes the private ownership.

TOWNSHIP 41.

There are no private claims recognized by the State on the portion of Township 41 lying within Hamilton County, except the 100-foot right of way of the railroad across one corner of it. That part of Township 41 in Herkimer County is owned by Mr. Aaron Lloyd.

Several camps have been erected on the township, but all are on State land, notably the one at Shallow Lake, consisting of two log cabins which in 1901 were in a fair state of repair. There are open lean-to camps at the Lower Brown's Tract Pond and at Queer Lake, and the remains of others at Haymarsh Pond, Palisade Camp, Twin Sisters Ponds, and elsewhere. The Sucker Brook highway, built by Mr. Durant in 1897 and 1898, crosses part of the township, but having been abandoned since the railroad was completed it has now fallen into a state of disrepair. There are a number of good trails on the township which could be much improved by a little labor, were there a resident game protector or forest warden.

The Estimate.

COMPARTMENTS.

To facilitate the estimate of the standing timber the three townships were divided into a number of compartments. These compartments consist of portions of the principal watersheds already described. The boundary lines of the compartments follow the natural divisions, except in one or two cases where from the nature of the topography it would be possible by a short, uphill haul to save a long distance in getting the logs to a shipping point. The compartment boundaries are shown on the accompanying map by broken red lines, and are designated by roman numerals, also in red. There are on the three townships ten compartments, which bear the following names:

- I. Shallow Lake.
- II. Seventh and Eighth Lakes and Brown's Tract Ponds.
- III. South Inlet.
- IV. Bear Pond in Township 6.
- V. Cedar River.
- VI. Silver Run.
- VII. Sumner Stream.
- VIII. Red River.
- IX. Fourth Lake.
- X. Big Moose Lake.

Following is a brief description of each compartment :

COMPARTMENT I. The Shallow Lake Compartment lies wholly in Township 41, occupying a broad belt across the lower center of the township. It comprises the valley of Sucker Brook. Tributary to this compartment is also the land about Cascade Lake, whose waters go out through the Moose River. Beaver Brook, in the southeastern part of Township 41, is included in this compartment. This stream empties into Beaver Bay in Raquette Lake.

COMPARTMENT II includes the southern edge of Township 41, the northern half of Township 5, except that portion falling into Compartment IX, and the northwestern corner of Township 6. It is made up of three watersheds, but on account of the low divides between them it is possible to haul all the logs from this compartment into Raquette Lake. The most important of the watersheds in the compartment is that containing Seventh and Eighth Lakes. Next is the Brown's Tract Inlet, draining the Brown's Tract Ponds. The third is that of Eagle Creek, in the southwestern corner of Township 41. This stream flows into Fourth Lake.

COMPARTMENT III lies in both Townships 5 and 6 and embraces all the streams tributary to South Bay of Raquette Lake. The most important valley in this watershed is that of South Inlet, in the northwestern corner of Township 6. The remaining part of Township 6 tributary to South Bay fronts on or is near the lake.

COMPARTMENT IV lies wholly in Township 6. It consists of the watershed of Bear Brook, which empties into Marion River just below Utowana Lake.

COMPARTMENT V is in the southeastern corner of Township 6 and covers the area draining into the Cedar River.

COMPARTMENT VI lies in the southwestern corner of Township 6 and is the valley of the north branch of Silver Run, a tributary of the South Branch of Moose River.

COMPARTMENT VII is also in the southwestern part of Township 6. A very little of the southeastern corner of Township 5 also comes into it. This compartment contains the headwaters of the Sumner Stream, which drains Lake Kora on the Woodruff Preserve.

COMPARTMENT VIII is altogether in Township 5, and consists of the upper part of the valleys of Benedict Creek and of Red River. Both these streams empty into the South Branch of Moose River. The greater part of Lot 4, Nivins Tract, is tributary to Benedict Creek.

COMPARTMENT IX is the small valley just north of Black Bear Mountain, lying partly in Township 5 and partly in Township 41. Its waters flow into Fourth Lake.

COMPARTMENT X includes practically the northern half of Township 41. With the exception of the extreme northeastern corner, where a few acres are tributary to Shingle Shanty Brook, all of this compartment slopes toward Big Moose Lake.

MERCHANTABLE AREA.

The merchantable area, as has been stated, is made up of the spruce land and the swamp types combined. The following table shows for each compartment in each township the number of acres of merchantable area. In the last column the acreage of the merchantable area is shown by compartments irrespective of township lines.

TABLE V.—TOTAL MERCHANTABLE AREA IN EACH COMPARTMENT.
Townships 5, 6 and 41.

COMPARTMENT.	Township 5.	Township 6.	Township 41.	Total area.
	Acres.	Acres.	Acres.	Acres.
I . . . . .	. . .	. . .	6,960	6,960
II	10,376	122	1,869	12,367
III	4,405	12,156	. . .	16,561
IV . . . . .	. . .	3,609	. . .	3,609
V . . . . .	. . .	2,779	. . .	2,779
VI . . . . .	. . .	1,332	. . .	1,332
VII	54	1,464	. . .	1,518
VIII	2,072	. . .	. . .	2,072
IX	246	. . .	48	294
X . . . . .	. . .	. . .	10,982	10,982
Total	17,153	21,462	19,859	58,474

VOLUME TABLES.

In the computation of the present yield of merchantable timber on Townships 5, 6 and 41, the volume tables prepared in connection with the working plan for Township 40 (Bulletin No. 30, page 23) were used, with the exception of those for white pine and for hemlock. These were computed during the autumn of

1901 on the tract of the Hon. William C. Whitney, Township 23, Totten and Crossfield Purchase, Hamilton County, and on the Rockefeller Tract, Townships 16 and 17, Macomb's Purchase, Great Tract, No. 1, Franklin County, 571 white pine and 1,445 hemlock trees being analyzed. The volume tables for white pine and hemlock follow:

TABLE VI.—MERCHANTABLE VOLUME PER TREE IN STANDARDS BY DIMICK'S RULE.

DIAMETER BREASTHIGH.			DIAMETER BREASTHIGH.		
White Pine.			Hemlock.		
Inches.	Standards.	Standards.	Inches.	Standards.	Standards.
10	0.5	0.02	26	4.7	2.13
11	.6	.03	27	5.2	2.38
12	.7	.05	28	5.7	2.69
13	.9	.08	29	6.2	3.00
14	1.0	.12	30	6.8	3.34
15	1.2	.18	31	7.4	3.67
16	1.4	.25	32	7.9	4.04
17	1.7	.34	33	8.5	4.41
18	2.0	.46	34	9.1	4.79
19	2.2	.59	35	9.7	5.19
20	2.5	.76	36	10.3	5.61
21	2.9	.94	37	10.9	6.04
22	3.2	1.16	38	11.4	6.45
23	3.5	1.36	39	12.0	6.86
24	3.9	1.61	40	12.6	7.27
25	4.3	1.85			

YIELD TABLES.

PRESENT YIELD.—The following tables show the present yield of merchantable timber for the eight commercially important trees growing on Townships 5, 6 and 41. They were compiled from the valuation surveys taken on the three townships in the following manner: The data from the surveys run in a given compartment show, when compiled, the average number of trees per acre of each species in each diameter class. By the use of volume tables the average yield per acre can be determined. The total yield for the compartment is then got by multiplying the yield for the average acre by the total number of acres in the compartment.

In the yield tables the results are given in standards by the Standard Rule for the conifers and for the broadleaf trees. In the tables the yield is shown to diameter limits of ten, twelve and fourteen inches diameter breasthigh for the soft woods and fifteen, seventeen and nineteen for the hardwoods.

The following table gives in markets by the Standard Rule the present yield of spruce on Township 5 to limits of ten, twelve and fourteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE VII.—SPRUCE—PRESENT YIELD—TOWNSHIP 5.
Merchantable Yield in Markets by Standard Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
		Acres.	Standards.		Standards.		Standards.	
II	Spruce Land	8,586	24.35	209,069.10	20.32	174,467.52	17.49	150,169.14
III		2,760	27.04	74,630.40	22.23	61,354.80	17.65	48,714.00
VIII		1,099	29.41	32,321.59	24.45	26,870.55	19.52	21,452.48
IX		246	25.58	6,292.68	20.12	4,949.52	14.87	3,658.02
Total		12,691	25.40	322,313.77	21.09	267,642.39	17.65	223,993.64
II	Swamp	1,790	22.00	39,380.00	17.21	30,805.90	13.26	23,735.40
III		1,645	10.70	17,599.36	7.27	11,959.15	4.74	7,797.30
VII		54						
VIII		973	17.02	16,560.46	11.65	11,335.45	8.15	7,929.95
Total		4,462	16.48	73,539.59	12.12	54,100.50	8.84	39,462.65
II	Spruce Land and Swamp	10,376	23.94	248,449.10	19.78	205,273.42	16.76	173,904.54
III		4,405	20.93	92,229.76	16.64	73,313.95	12.83	56,511.30
VII		54						
VIII		2,072	23.59	48,882.05	18.44	38,206.00	14.18	29,382.43
IX		246	25.58	6,292.68	20.12	4,949.52	14.87	3,658.02
Total		17,153	23.08	395,853.59	18.76	321,742.89	15.36	263,456.29

The following table gives in markets by Standard Rule the present yield of spruce on Township 6 to limits of ten, twelve and fourteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE VIII.—SPRUCE—PRESENT YIELD—TOWNSHIP 6.
Merchantable Yield in Markets by Standard Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
		Ac. es.	Standards.		Standards.		Standards.	
II	Spruce Land	84	16.79	1,403.64	13.52	1,130.28	10.88	907.57
III		8,490	26.23	222,682.21	21.72	184,394.11	16.83	142,879.97
IV		2,587	33.30	86,140.44	29.05	75,146.54	23.98	62,031.46
V		1,611	21.85	35,204.72	17.16	27,648.19	11.87	19,124.94
VI		1,332	43.39	57,804.16	38.26	50,969.97	31.88	42,470.54
VII		1,194	25.59	30,541.67	21.17	25,266.40	17.61	21,017.54
Total		15,298	28.36	433,776.84	23.83	364,555.49	18.85	288,432.02
II	Swamp	38	19.39	736.82	15.31	581.78	11.69	444.22
III		3,666	19.39	71,075.98	15.31	56,120.34	11.69	42,850.86
IV		1,022	17.75	18,140.50	14.26	14,579.42	10.79	11,031.70
V		1,168	14.10	16,468.80	10.02	11,703.36	6.40	7,475.20
VII		270	15.88	4,287.60	11.38	3,072.60	7.02	1,895.40
Total		6,164	17.96	110,709.70	13.96	86,057.50	10.33	63,697.38
II	Spruce Land and Swamp	122	17.54	2,140.46	14.03	1,712.06	11.08	1,351.79
III		12,156	24.17	293,758.19	19.79	240,514.45	15.28	185,730.83
IV		3,609	28.90	104,280.94	24.86	89,725.96	20.24	73,063.16
V		2,779	18.59	51,673.52	14.16	39,351.55	9.57	26,600.14
VI		1,332	43.39	57,804.16	38.26	50,969.97	31.88	42,470.54
VII		1,464	23.79	34,829.27	19.36	28,339.00	15.65	22,912.94
Total		21,462	25.36	544,486.54	21.00	450,612.99	16.41	352,129.40

The following table gives in markets by Standard Rule the present yield of spruce on Township 41 to limits of ten, twelve, and fourteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE IX.—SPRUCE—PRESENT YIELD—TOWNSHIP 41.
Merchantable Yield in Markets by Standard Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Tota. yield.
		Acres.	Standards.		Standards.		Standards.	
I	Spruce Land	5,430	34.22	185,814.60	29.20	158,556.00	23.40	126,510.00
II		1,366	24.22	33,084.53	20.47	27,962.02	16.35	22,334.10
IX		48	32.38	1,554.24	23.66	1,135.68	17.61	845.28
X		7,362	39.92	293,891.04	34.77	255,976.74	31.74	233,669.88
Total		14,206	36.20	514,344.41	31.22	443,630.44	26.99	383,368.26
I	Swamp	1,530	19.19	29,360.70	14.89	22,781.70	10.86	2,845.80
II		502	19.40	9,738.80	15.20	7,630.40	11.80	5,923.60
X		3,621	24.68	89,366.28	20.37	73,759.77	15.95	57,754.95
Total		5,653	22.73	128,465.78	18.43	104,171.87	11.77	66,524.35
I	Spruce Land and Swamp	6,960	30.92	215,175.30	26.05	181,337.70	18.59	129,364.80
II		1,869	22.91	42,823.32	19.04	35,592.42	15.12	28,257.70
IX		48	32.38	1,554.24	23.66	1,135.68	17.60	845.28
X		10,982	34.02	383,257.32	30.03	329,736.51	26.54	291,424.83
Total		19,859	32.37	642,810.18	27.58	547,802.31	22.65	449,892.61

The following table gives in markets by Standard Rule the present yield of balsam on Township 5 to limits of ten, twelve and fourteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE X.—BALSAM—PRESENT YIELD—TOWNSHIP 5.
Merchantable Yield in Markets by Standard Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
		Acres.	Standards.		Standards.		Standards.	
II	Spruce Land	8,586	2.48	21,293.28	1.43	12,277.98	0.59	5,065.74
III		2,760	2.03	5,602.80	1.03	2,842.80	.39	1,076.40
VIII		1,099	2.02	2,219.98	1.25	1,373.75	.52	571.48
IX		246						
Total		12,691	2.29	29,116.06	1.30	16,494.53	0.53	6,713.62
II	Swamp	1,790	10.27	18,383.30	5.24	9,379.60	2.07	3,705.30
III		1,645	10.38	17,075.10	5.13	8,438.85	1.92	3,158.40
VII		54						
VIII		973	7.69	8,455.37	3.11	3,026.03	1.02	992.46
Total		4,462	9.84	43,913.77	4.67	20,844.48	1.76	7,856.16
II	Spruce Land and Swamp	10,376	3.82	39,676.58	2.08	21,657.58	0.84	8,771.04
III		4,405	5.15	22,677.90	2.56	11,281.65	.96	4,234.80
VII		54						
VIII		2,072	5.15	10,675.35	2.12	4,409.78	.75	1,563.94
IX		246						
Total		17,153	4.26	73,029.83	2.18	37,349.01	0.85	14,569.78

The following table gives in markets by Standard Rule the present yield of balsam on Township 6 to limits of ten, twelve and fourteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE XI.—BALSAM—PRESENT YIELD—TOWNSHIP 6.
Merchantable Yield in Markets by Standard Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
			Standards.		Standards.		Standards.	
II	Spruce Land	84	0.63	52.92	0.33	27.72	. . . . .	. . . . .
III		8,490	2.77	23,517.30	1.44	12,225.60	0.48	4,075.20
IV		2,587	2.94	7,605.78	1.36	3,518.32	.52	1,345.24
V		1,611	2.74	4,414.14	1.27	2,045.97	.32	515.52
VI		1,332	4.31	5,740.92	1.77	2,357.64	.61	812.52
VII		1,194	2.77	3,307.38	1.36	1,623.84	.34	405.96
Total		15,298	2.92	44,638.44	1.42	21,799.09	0.47	7,154.44
II	Swamp	38	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
III		3,666	8.69	31,857.54	3.84	14,077.44	1.22	4,472.52
IV		1,022	7.84	8,012.48	3.76	3,842.72	1.36	1,399.92
V		1,168	8.38	9,787.84	3.32	3,877.76	.77	899.36
VII		270	5.65	1,525.50	2.44	658.80	.79	213.30
Total		6,164	8.30	51,183.36	3.64	22,456.72	1.13	6,985.10
II	Spruce Land and Swamp	122	0.43	52.92	0.23	27.72	. . . . .	. . . . .
III		12,156	4.56	55,374.84	2.16	26,303.04	0.70	8,547.72
IV		3,609	4.33	15,618.26	2.04	7,361.04	.76	2,735.16
V		2,779	6.62	18,391.98	2.66	7,383.73	.65	1,799.88
VI		1,332	4.31	5,740.92	1.77	2,357.64	.61	812.52
VII		1,464	3.30	4,832.88	1.56	2,282.64	.42	619.26
Total		21,462	4.66	100,011.80	2.13	45,715.81	0.68	14,514.54

The following table gives in markets by Standard Rule the present yield of balsam on Township 41 to limits of ten, twelve and fourteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE XII.—BALSAM—PRESENT YIELD—TOWNSHIP 41.
Merchantable Yield in Markets by Standard Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
		Acres.	Standards.—		Standards.—		Standards.—	
I	Spruce Land	5,430	1.75	9,502.50	0.93	5,049.90	0.41	2,226.30
II		1,366	1.92	2,622.72	1.24	1,693.84	.57	778.62
IX		48	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
X		7,362	2.12	15,607.44	1.23	9,055.26	.57	4,196.34
Total		14,206	1.95	27,732.66	1.11	15,799.00	0.51	7,201.26
I	Swamp	1,530	6.59	10,082.70	2.89	4,421.70	1.09	1,667.70
II		502	7.52	3,775.04	3.87	1,942.74	1.47	737.94
X		3,621	11.64	42,148.44	6.12	22,160.52	2.39	8,653.29
Total		5,653	9.92	56,006.18	5.05	28,524.96	1.97	11,058.93
I	Spruce Land and Swamp	6,960	2.81	19,585.20	1.36	9,471.60	0.56	3,894.00
II		1,869	3.42	6,397.76	1.95	3,636.58	.80	1,516.56
IX		48	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
X		10,982	5.26	57,755.88	2.84	31,215.78	1.17	12,849.63
Total		19,859	4.22	83,738.84	2.23	44,323.96	0.92	18,260.19

The following table gives in markets by Standard Rule the present yield of white pine on Township 5 to limits of ten, twelve and fourteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE XIII.—WHITE PINE—PRESENT YIELD—TOWNSHIP 5.
Merchantable Yield in Markets by Standard Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
		Acres.	Standards.		Standards.		Standards.	
II	Spruce Land	8,586	0.08	686.88	0.08	686.88	0.07	601.02
III		2,760	.15	414.00	.13	358.80	.13	358.80
VIII		1,099	. . . .	. . . . .	. . . .	. . . . .	. . . .	. . . . .
IX		246	. . . .	. . . . .	. . . .	. . . . .	. . . .	. . . . .
Total		12,691	0.09	1,100.88	0.08	1,045.68	0.08	959.82
II	Swamp	1,790	1.22	2,183.80	1.18	2,112.20	1.16	2,076.40
III		1,645	1.28	2,105.60	1.23	2,023.35	1.10	1,809.50
VII		54	. . . .	. . . . .	. . . .	. . . . .	. . . .	. . . . .
VIII		973	. . . .	. . . . .	. . . .	. . . . .	. . . .	. . . . .
Total		4,462	0.96	4,289.40	0.93	4,135.55	0.87	3,885.90
II	Spruce Land and Swamp	10,376	0.28	2,870.68	0.27	2,799.08	0.26	2,677.42
III		4,405	.57	2,519.60	.54	2,382.15	.49	2,168.30
VII		54	. . . .	. . . . .	. . . .	. . . . .	. . . .	. . . . .
VIII		2,072	. . . .	. . . . .	. . . .	. . . . .	. . . .	. . . . .
IX		246	. . . .	. . . . .	. . . .	. . . . .	. . . .	. . . . .
Total		17,153	0.31	5,390.28	0.30	5,181.23	0.28	4,845.72

The following table gives in markets by Standard Rule the present yield of white pine on Township 6 to limits of ten, twelve and fourteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE XIV.—WHITE PINE—PRESENT YIELD—TOWNSHIP 6.

Merchantable Yield in Markets by Standard Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
		Acres.	Standards		Standards.		Standards.	
II		84						
III		8,490	0.08	679.20	0.03	679.20	0.08	679.20
IV	Spruce Land	2,587	.39	1,008.93	.38	983.06	.36	931.32
V		1,611						
VI		1,332	.01	13.32	.01	13.32		
VII		1,194	.06	71.64	.06	71.64	.04	47.76
Total		15,298	0.12	1,773.09	0.11	1,747.22	0.11	1,658.28
II		38						
III	Swamp	3,666	2.00	7,332.00	1.99	7,295.34	1.95	7,148.70
IV		1,022	1.00	1,022.00	1.00	1,022.00	.97	991.34
V		1,168						
VII		270						
Total		6,164	1.36	8,354.00	1.35	8,317.34	1.32	8,140.04
II		122						
III	Spruce Land and Swamp	12,156	0.66	8,011.20	0.66	7,974.54	0.64	7,827.90
IV		3,609	.56	2,030.93	.56	2,005.06	.53	1,922.66
V		2,779						
VI		1,332	.01	13.32	.01	13.32		
VII		1,464	.05	71.64	.05	71.64	.03	47.76
Total		21,462	0.47	10,127.09	0.47	10,064.56	0.46	9,798.32

The following table gives in markets by Standard Rule the present yield of white pine on Township 41 to limits of ten, twelve and fourteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE XV.—WHITE PINE—PRESENT YIELD—TOWNSHIP 41.
Merchantable Yield in Markets by Standard Rule.

NUMBER OF COMPARTMENT.	Type.	Arca.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
		Acres.	Standards.		Standards.		Standards.	
I	Spruce Land	5,430	0.14	760.20	0.13	705.90	0.11	597.30
II		1,366	.08	109.28	.08	109.28	.08	109.28
IX		48						
X		7,362	0.41	3,018.42	.41	3,018.42	.41	3,018.42
Total		14,206	0.27	3,887.90	0.27	3,833.60	0.26	3,725.00
I	Swamp	1,530	6.23	9,531.90	6.13	9,378.90	6.06	9,271.80
II		502	.80	401.60	.69	346.38	.62	311.24
X		3,621	3.18	11,514.78	3.16	11,442.36	3.11	11,261.31
Total		5,653	3.79	21,448.28	3.74	21,167.64	3.69	20,844.35
I	Spruce Land and Swamp	6,960	1.48	10,292.10	1.45	10,084.80	1.42	9,869.10
II		1,869	.27	510.88	.24	455.66	.22	420.52
IX		48						
X		10,982	1.32	14,533.20	1.32	14,460.78	1.30	14,279.73
Total		19,859	1.28	25,336.18	1.26	25,001.24	1.24	24,569.35

The following table gives in markets by Standard Rule the present yield of hemlock on Township 5 to limits of ten, twelve and fourteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE XVI.—HEMLOCK—PRESENT YIELD—TOWNSHIP 5.
Merchantable Yield in Markets by Standard Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
			Standards.		Standards.		Standards.	
II	Spruce Land	8,586	8.88	76,243.68	8.61	73,925.46	8.01	68,773.86
III		2,760	3.74	10,322.40	3.62	9,991.20	3.39	9,366.40
VIII		1,099	3.70	4,066.30	3.59	3,945.41	3.45	3,791.55
IX		246	7.04	1,731.84	6.25	1,537.50	5.25	1,291.50
Total		12,691	7.28	92,364.22	7.08	89,399.57	5.66	83,223.31
II	Swamp	1,790	5.05	9,039.50	4.58	8,189.20	3.97	7,106.30
III		1,645	1.19	1,957.55	1.15	1,891.75	1.11	1,825.95
VII		54						
VIII		973	1.60	1,556.80	1.49	1,449.77	1.49	1,449.77
Total		4,462	2.81	12,553.85	2.58	11,530.72	2.33	10,382.02
II	Spruce Land and Swamp	10,376	8.22	85,283.18	7.91	82,114.66	7.31	75,880.16
III		4,405	2.79	12,279.95	2.70	11,882.95	2.54	11,182.35
VII		54						
VIII		2,072	2.71	5,623.10	2.60	5,395.18	2.53	5,241.32
IX		246	7.04	1,731.84	6.25	1,537.50	5.25	1,291.50
Total		17,153	6.12	104,918.07	5.88	100,930.29	5.44	93,595.33

The following table gives in markets by Standard Rule the present yield of hemlock on Township 6 to limits of ten, twelve and fourteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE XVII.—HEMLOCK—PRESENT YIELD—TOWNSHIP 6.
Merchantable Yield in Markets by Standard Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
		Acres.	Standards.		Standards.		Standards.	
II	Spruce Land	84	8.11	678.00	7.85	656.26	7.66	640.38
III		8,490	6.72	57,052.80	6.51	55,269.90	6.15	52,213.50
IV		2,587	7.04	18,212.48	6.89	17,824.43	6.65	17,203.55
V		1,611	.24	386.64	.21	338.31	.17	273.87
VI		1,332	1.18	1,571.76	1.16	1,545.12	1.14	1,518.48
VII		1,194	1.27	1,516.38	1.22	1,456.68	1.17	1,396.98
Total		15,298	5.19	79,418.06	5.04	77,090.70	4.79	73,246.76
II	Swamp	38	. . .	. . . . .	. . .	. . . . .	. . .	. . . . .
III		3,666	2.56	9,384.96	2.46	9,018.36	2.21	8,101.86
IV		1,022	2.71	2,769.62	2.64	2,698.08	2.41	2,463.02
V		1,168	.07	81.76	.07	81.76	.05	58.40
VII		270	.37	99.90	.37	99.90	.37	99.90
Total		6,164	2.00	12,336.24	1.93	11,898.10	1.74	10,723.18
II	Spruce Land and Swamp	122	5.56	678.00	5.38	656.26	5.25	640.38
III		12,156	5.47	66,437.76	5.29	64,288.26	4.96	60,315.36
IV		3,609	5.81	20,982.10	5.69	20,522.51	5.45	19,666.57
V		2,779	.17	468.40	.15	420.07	.15	332.27
VI		1,332	1.18	1,571.76	1.16	1,545.12	1.14	1,518.48
VII		1,464	1.10	1,616.28	1.06	1,556.58	1.02	1,496.88
Total		21,462	4.28	91,754.30	4.15	88,988.80	3.91	83,969.94

The following table gives in markets by Standard Rule the present yield of hemlock on Township 41 to limits of ten, twelve and fourteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE XVIII.—HEMLOCK—PRESENT YIELD—TOWNSHIP 41.
Merchantable Yield in Markets by Standard Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
		Acres.	Standards.		Standards.		Standards.	
I	Spruce Land	5,430	7.19	39,041.70	6.79	36,869.70	6.25	34,937.50
II		1,366	7.72	10,545.52	6.96	9,507.36	6.09	8,318.94
IX		48	16.50	792.00	15.81	758.88	14.25	684.00
X		7,362	3.72	27,386.64	3.54	26,061.48	3.32	24,441.84
Total		14,206	5.47	77,765.86	5.15	73,197.42	4.74	67,382.28
I	Swamp	1,530	2.17	3,320.10	1.85	2,830.50	1.52	2,325.60
II		502	2.74	1,375.48	2.44	1,224.88	2.17	1,089.34
X		3,621	1.17	4,236.57	1.09	3,946.89	1.02	3,693.42
Total		5,653	1.58	8,932.15	1.42	8,002.27	1.26	7,108.36
I	Spruce Land and Swamp	6,960	6.09	42,361.80	5.70	39,700.20	5.21	36,263.10
II		1,869	6.38	11,921.00	5.74	10,732.24	5.03	9,408.28
IX		48	16.50	792.00	15.81	758.88	14.25	684.00
X		10,982	2.88	31,623.21	2.73	30,008.37	2.56	28,135.26
Total		19,859	4.37	86,698.01	4.09	81,199.69	3.75	74,490.64

The following table gives in board feet by old Scribner Rule the present yield of yellow birch on Township 5 to limits of fifteen, seventeen and nineteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE XIX.—BIRCH—PRESENT YIELD—TOWNSHIP 5.
Merchantable Yield in Board Feet by Old Scribner Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 15 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 17 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 19 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
		Acres.	Board feet.		Board feet.		Board feet.	
II	Spruce Land	8,586	2,431	20,872,566	2,202	18,906,372	1,910	16,399,260
III		2,760	2,872	7,926,720	2,614	7,214,640	2,314	6,386,640
VIII		1,099	2,667	2,931,033	2,431	2,671,669	2,083	2,289,217
XI		246	1,985	488,310	1,747	429,762	1,513	372,198
Total		12,691	2,539	32,218,629	2,303	29,222,443	2,005	25,447,315
II	Swamp	1,790	1,280	2,291,200	1,037	1,856,230	798	1,428,420
III		1,645	1,258	2,069,410	1,029	1,692,705	786	1,292,970
VII		54	. . .	. . . . .	. . .	. . . . .	. . .	. . . . .
VIII		973	1,043	1,014,839	816	793,568	501	487,473
Total		4,462	1,205	5,375,449	973	4,342,503	719	3,208,863
II	Spruce Land and Swamp	10,376	2,232	23,163,766	2,001	20,762,602	1,718	17,827,680
III		4,405	2,269	9,996,130	2,022	8,907,345	1,743	7,679,610
VII		54	. . .	. . . . .	. . .	. . . . .	. . .	. . . . .
VIII		2,072	1,904	3,945,872	1,672	3,465,237	1,340	2,776,690
IX		246	1,985	488,310	1,747	429,762	1,513	372,198
Total		17,153	2,192	37,594,078	1,957	33,564,946	1,671	28,656,178

The following table gives in board feet by old Scribner Rule the present yield of yellow birch on Township 6 to limits of fifteen, seventeen and nineteen inches, diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE XX.—BIRCH—PRESENT YIELD—TOWNSHIP 6.
Merchantable Yield in Board Feet by Old Scribner Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 15 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 17 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 19 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
			Board feet.		Board feet.		Board feet.	
II	Spruce Land	84	280	23,520	247	20,748	226	18,984
III		8,490	2,475	21,012,750	2,226	18,898,740	1,883	15,986,670
IV		2,587	2,416	6,251,092	2,159	5,585,333	1,812	4,687,644
V		1,611	3,494	5,628,834	3,132	5,045,652	2,695	4,341,645
VI		1,332	2,264	3,015,648	1,982	2,640,024	1,615	2,151,180
VII		1,194	3,012	3,596,328	2,655	3,170,070	2,243	2,678,142
Total		15,298	2,584	39,528,172	2,311	35,360,567	1,952	29,864,265
II	Swamp	38						
III		3,666	947	3,471,702	746	2,734,836	516	1,891,656
IV		1,022	729	745,038	542	553,924	411	527,352
V		1,168	794	917,392	676	789,568	493	575,824
VII		270	750	202,500	486	131,220	314	84,780
Total		6,164	866	5,336,632	683	4,209,548	500	3,079,612
II	Spruce Land and Swamp	122	193	23,520	170	20,748	156	18,984
III		12,156	2,014	24,484,452	1,780	21,633,576	1,470	17,878,326
IV		3,609	1,938	6,996,130	1,701	6,139,257	1,445	5,214,996
V		2,779	2,355	6,546,226	2,100	5,835,220	1,770	4,917,469
VI		1,332	2,264	3,015,648	1,982	2,640,024	1,615	2,151,180
VII		1,464	2,595	3,798,828	2,255	3,301,290	1,887	2,762,922
Total		21,462*	2,090	44,864,804	1,844	39,570,115	1,535	32,943,877

The following table gives in board feet by old Scribner Rule the present yield of yellow birch on Township 41 to limits of fifteen, seventeen and nineteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre in each compartment in the township for spruce land and swamp, separately and combined.

TABLE XXI.—BIRCH—PRESENT YIELD—TOWNSHIP 41.
Merchantable Yield in Board Feet by Old Scribner Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 15 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 17 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 19 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
			Board feet.		Board feet.		Board feet.	
I	Spruce Land	5,430	2,663	14,450,090	1,249	6,782,070	898	4,876,140
II		1,366	1,677	2,290,782	1,476	2,016,216	1,253	1,711,598
IX		48	2,266	108,768	2,187	104,976	1,688	81,024
X		7,362	2,931	21,578,022	2,675	19,693,350	2,318	17,065,116
Total		14,206	2,706	38,427,662	2,013	28,596,612	1,671	23,733,878
I	Swamp	1,530	817	1,250,010	653	999,090	527	806,310
II		502	999	501,498	823	413,146	680	341,360
X		3,621	864	3,128,544	718	2,599,878	548	1,984,308
Total		5,653	863	4,880,052	710	4,012,114	554	3,131,978
I	Spruce Land and Swamp	6,960	2,260	15,710,100	1,118	7,781,160	816	5,682,450
II		1,869	1,494	2,792,280	1,300	2,429,362	1,098	2,052,958
IX		48	2,266	108,768	2,187	104,976	1,688	81,024
X		10,982	2,250	24,706,566	2,030	22,293,228	1,735	19,049,424
Total		19,859	2,181	43,317,714	1,642	32,608,726	1,353	26,865,856

The following table gives in board feet by old Scribner Rule the present yield of sugar maple on Township 5 to limits of fifteen, seventeen and nineteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE XXII.—SUGAR MAPLE—PRESENT YIELD—TOWNSHIP 5.

Merchantable Yield in Board Feet by Old Scribner Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 15 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 17 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 19 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
		Acres.	Board feet.		Board feet.		Board feet.	
II	Spruce Land	8,586	998	8,568,828	802	6,885,972	599	5,143,014
III		2,760	928	2,561,280	741	2,045,160	567	1,564,920
VIII		1,099	438	481,362	299	328,601	182	200,018
IX		246	373	91,758	171	42,066	43	10,578
Total		12,691	922	11,703,228	733	9,301,799	545	6,918,530
II	Swamp	1,790	150	268,500	104	186,160	57	102,030
III		1,645	107	176,015	84	133,180	75	123,375
VII		54						
VIII		973	12	11,676	7	6,811		
Total		4,462	102	456,191	74	331,151	55	225,405
II	Spruce Land and Swamp	10,376	852	8,837,328	682	7,072,132	505	5,245,044
III		4,405	621	2,737,295	495	2,183,340	383	1,688,295
VII		54						
VIII		2,072	238	493,038	114	335,412	97	200,018
IX		246	373	91,758	171	42,066	43	10,578
Total		17,153	709	12,159,419	562	9,632,950	416	7,143,935

The following table gives in board feet by old Scribner Rule the present yield of sugar maple on Township 6 to limits of fifteen, seventeen and nineteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE XXIII.—SUGAR MAPLE—PRESENT YIELD—TOWNSHIP 6.
Merchantable Yield in Board Feet by Old Scribner Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 15 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 17 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 19 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
		Acres.	—Board Feet.—		—Board Feet.—		—Board Feet.—	
II	Spruce Land	84	247	20,748	205	17,220	205	17,220
III		8,490	769	6,528,810	630	5,348,700	482	4,092,180
IV		2,587	692	1,790,204	574	1,484,938	458	1,184,846
V		1,611	425	684,675	351	565,461	268	431,748
VI		1,332	376	500,832	299	398,268	216	287,712
VII		1,194	1,024	1,222,656	832	993,408	576	687,744
Total		15,298	703	10,747,925	576	8,807,995	838	6,701,450
II	Swamp	38	. . .	. . . . .	. . .	. . . . .	. . .	. . . . .
III		3,666	47	172,302	37	135,632	27	98,780
IV		1,022	80	81,760	58	59,276	35	35,770
V		1,168	. . .	. . . . .	. . .	. . . . .	. . .	. . . . .
VII		270	36	9,720	21	5,670	. . .	. . . . .
Total		6,164	43	263,782	33	200,578	22	134,552
II	Spruce Land and Swamp	122	170	20,748	141	17,220	141	17,220
III		12,156	551	6,701,112	451	5,484,342	345	4,191,162
IV		3,609	519	1,871,964	428	1,544,214	338	1,220,616
V		2,779	246	684,675	203	565,461	155	431,748
VI		1,332	376	500,832	299	398,268	216	287,712
VII		1,464	842	1,232,376	682	999,078	469	687,744
Total		21,462	513	11,011,707	420	9,008,583	319	6,836,202

The following table gives in board feet by old Scribner Rule the present yield of sugar maple on Township 41 to limits of fifteen, seventeen and nineteen inches diameter breasthigh. The table shows, also, the total present yield and the average yield per acre on each compartment in the township for spruce land and swamp, separately and combined.

TABLE XXIV.—SUGAR MAPLE—PRESENT YIELD—TOWNSHIP 41.
Merchantable Yield in Board Feet by Old Scribner Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 15 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 17 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 19 INCHES IN DIAMETER BREASTHIGH.	
			Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
		Acres.	Board feet.		Board feet.		Board feet.	
I	Spruce Land	5,430	701	3,806,430	540	2,932,200	410	2,226,300
II		1,366	762	1,040,892	520	710,320	317	433,000
IX		48	152	7,296	. . . . .	. . . . .	. . . . .	. . . . .
X		7,362	449	3,305,558	346	2,547,252	242	1,781,604
Total		14,206	574	8,160,176	436	6,189,772	313	4,440,904
I	Swamp	1,530	74	113,220	43	65,790	30	45,900
II		502	171	85,842	127	63,754	75	37,650
X		3,621	64	231,744	48	173,808	37	133,977
Total		5,653	76	430,806	54	303,352	38	217,527
I	Spruce Land and Swamp	6,960	563	3,919,650	431	2,997,990	326	2,272,200
II		1,869	603	1,126,734	414	774,074	253	470,650
IX		48	152	7,296	. . . . .	. . . . .	. . . . .	. . . . .
X		10,982	322	3,537,282	248	2,721,060	174	1,915,581
Total		19,859	433	8,590,962	327	6,493,124	235	4,658,431

The following table is a summary of Tables VII to XXIV, with the yields of cedar and beech included and Township 40 added. The standards of the softwoods have been reckoned at 200 board feet each.

TABLE XXV.—PRESENT YIELD ON TOWNSHIPS 5, 6, 40 AND 41 SEPARATELY.

Merchantable Yield in Board Feet by Old Scribner Rule.

TOWNSHIP 5—17,153 ACRES.

SPECIES.	CUTTING TO BREASTHIGH DIAMETER LIMITS OF 10 AND 15 INCHES FOR SOFT- WOODS AND HARDWOODS, RESPECTIVELY.		CUTTING TO BREASTHIGH DIAMETER LIMITS OF 12 AND 17 INCHES FOR SOFT- WOODS AND HARDWOODS, RESPECTIVELY.		CUTTING TO BREASTHIGH DIAMETER LIMITS OF 14 AND 19 INCHES FOR SOFTWOODS AND HARD- WOODS, RESPECTIVELY.	
	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
	Board feet.		Board feet.		Board feet.	
Spruce	4,616	70,170,718	3,752	64,348,578	3,072	52,691,258
Balsam	852	14,605,966	436	7,469,802	170	2,913,956
White pine	62	1,078,056	60	1,036,246	56	969,144
Hemlock	1,224	20,983,814	1,176	20,186,058	1,088	18,719,066
Cedar	116	1,997,980	92	1,591,500	68	1,165,790
Birch	2,192	37,594,078	1,957	33,564,946	1,671	28,656,178
Sugar maple	709	12,159,419	562	9,632,950	416	7,143,935
Beech	551	9,448,139	348	5,981,263	199	3,409,784
Total	10,322	177,038,170	8,383	143,811,343	6,740	115,669,111

TOWNSHIP 6—21,462 ACRES.

Spruce	5,072	108,897,308	4,200	90,122,598	3,282	70,425,880
Balsam	932	20,002,360	426	9,143,162	136	2,902,908
White pine	94	2,025,418	94	2,012,912	92	1,959,664
Hemlock	856	18,350,860	830	17,797,760	782	16,793,988
Cedar	28	610,994	22	475,590	18	370,622
Birch	2,090	44,864,804	1,844	39,570,115	1,535	32,943,877
Sugar maple	513	11,011,707	420	9,008,583	319	6,836,202
Beech	175	3,769,440	99	2,143,294	55	1,199,912
Total	9,760	209,532,891	7,935	170,274,014	6,219	133,433,053

TABLE XXV.—(Concluded).
TOWNSHIP 40—16,896 ACRES.

SPECIES.	CUTTING TO BREASTHIGH DIAMETER LIMITS OF 10 AND 15 INCHES FOR SOFT- WOODS AND HARDWOODS, RESPECTIVELY.		CUTTING TO BREASTHIGH DIAMETER LIMITS OF 12 AND 17 INCHES FOR SOFT- WOODS AND HARDWOODS, RESPECTIVELY.		CUTTING TO BREASTHIGH DIAMETER LIMITS OF 14 AND 19 INCHES FOR SOFTWOODS AND HARD- WOODS, RESPECTIVELY.	
	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
	Board feet.		Board feet.		Board feet.	
Spruce	4,588	77,519,378	3,886	65,657,510	3,112	52,590,736
Balsam	638	10,783,622	324	5,463,184	124	2,092,434
White pine	336	5,678,236	334	5,654,130	332	5,611,552
Hemlock	1,770	29,905,416	1,702	28,766,876	1,588	26,852,698
Cedar	126	2,118,558	104	1,755,420	76	1,291,966
Birch	1,624	27,438,598	1,459	24,655,158	1,132	19,122,098
Sugar maple	507	8,565,062	397	6,708,675	291	4,913,563
Beech	397	6,699,364	262	4,431,985	149	2,519,119
Total	9,986	168,708,234	8,468	143,092,938	6,804	114,994,166

TOWNSHIP 41—19,859 ACRES.

Spruce	6,474	128,562,036	5,516	109,560,462	4,530	89,978,522
Balsam	844	16,747,768	446	8,864,792	184	3,652,038
White pine	256	5,067,236	252	5,000,248	248	4,913,870
Hemlock	874	17,339,602	818	16,239,938	750	14,898,128
Cedar	54	1,061,416	42	846,332	30	586,470
Birch	2,181	43,317,714	1,642	32,608,726	1,353	26,865,856
Sugar maple	433	8,590,962	327	6,493,124	235	4,658,431
Beech	789	15,661,822	495	9,824,134	328	6,519,575
Total	11,905	236,348,556	9,538	189,437,756	7,658	152,072,890

TABLE XXVI.—PRESENT YIELD ON THE WHOLE BLOCK OF FOUR TOWNSHIPS —
TOWNSHIPS 5, 6, 40 AND 41 — 75,370 ACRES.
Merchantable Yield in Board Feet by Old Scribner Rule.

SPECIES.	CUTTING TO BREASTHIGH DIAMETER LIMITS OF 10 AND 15 INCHES FOR SOFT- WOODS AND HARDWOODS, RESPECTIVELY.		CUTTING TO BREASTHIGH DIAMETER LIMITS OF 12 AND 17 INCHES FOR SOFT- WOODS AND HARDWOODS, RESPECTIVELY.		CUTTING TO BREASTHIGH DIAMETER LIMITS OF 14 AND 19 INCHES FOR SOFTWOODS AND HARD- WOODS, RESPECTIVELY.	
	Average		Average		Average	
	yield per acre	Total yield.	yield per acre	Total yield.	yield per acre.	Total yield.
	Board feet. —		Board feet. —		Board feet. —	
Spruce	5,229	394,149,440	4,374	329,689,148	3,525	265,686,396
Balsam	824	62,139,716	411	30,940,940	153	11,561,336
White pine	184	13,848,946	182	13,703,536	178	13,454,230
Hemlock	1,149	86,579,692	1,101	82,990,632	1,025	77,263,880
Cedar	77	5,788,948	62	4,668,842	45	3,414,848
Birch	2,033	153,215,194	1,730	130,398,945	1,428	107,588,009
Sugar maple	535	40,327,150	422	31,843,332	313	23,552,131
Beech	472	35,578,765	297	22,380,676	181	13,648,390
Total	10,503	791,627,851	8,579	646,616,051	6,848	516,169,220

PINE LAND — TOWNSHIP 5.—Table XXVII shows the present yield of white pine on the “pine land” area in the southwestern corner of Township 5. As pointed out in the description of this area (page 383), the pine land type is made up of parts of the spruce land and the swamp types, and is used merely to obtain the yield of white pine in this particular stand. The table shows the yield for the pine land both in Compartment VIII and in Compartment XII, the latter being Lot 4 of the Nivins Tract.

TABLE XXVII.—WHITE PINE—PRESENT YIELD—PINE LAND, TOWNSHIP 5.
Merchantable Volume in Markets by Standard Rule.

NUMBER OF COMPARTMENT.	Type.	Area.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BREASTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BREASTHIGH.	
			Average		Average		Average	
			yield per acre.	Total yield.	yield per acre.	Total yield.	yield per acre.	Total yield.
		Acres.	Standards. —		Standards. —		Standards. —	
VIII	Pine (	786	37.54	29,506.44	37.39	29,388.54	37.05	29,121.30
XII	Land (	211	25.96	5,477.56	25.85	5,454.35	25.62	5,405.82
Total		997	35.09	34,984.00	34.95	34,842.89	34.63	34,527.12

Table XXVIII gives in markets by Standard Rule the present yield for softwoods on Lot 4, Nivins Tract. Table XXIX gives the present yield for hardwoods on the same area. Both tables show also the total yield and the average yield per acre on the lot for spruce land and swamp, separately and combined, and Table XXVIII shows the total present yield and the average yield per acre of white pine on the pine land.

TABLE XXVIII.—SOFTWOODS—PRESENT YIELD—TOWNSHIP 5.
Merchantable Volume in Markets by Standard Rule.
SPRUCE LAND—696 ACRES.

SPECIES.	CUTTING TO A LIMIT OF 10 INCHES IN DIAMETER BRESTHIGH.		CUTTING TO A LIMIT OF 12 INCHES IN DIAMETER BRESTHIGH.		CUTTING TO A LIMIT OF 14 INCHES IN DIAMETER BRESTHIGH.	
	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
	—Standards.—		—Standards.—		—Standards.—	
Spruce	28.11	19,564.56	21.66	15,075.36	15.22	10,593.12
Hemlock	3.69	2,568.24	3.48	2,422.08	3.17	2,206.32
Balsam	3.60	2,505.60	2.19	1,524.24	.94	654.24
White pine . . . . .	.64	445.44	.62	431.52	.62	431.52
Dead spruce . . . . .	.09	62.64	.09	62.64	.09	62.64
Total	36.13	25,146.48	28.04	19,515.84	20.04	13,947.84

SWAMP LAND—336 ACRES.

Spruce	19.87	6,676.32	14.06	4,724.16	9.53	3,202.08
Balsam	8.16	2,741.76	3.57	1,199.52	.82	275.52
White pine	2.60	873.60	2.56	860.16	2.56	860.16
Hemlock . . . . .	.44	147.84	.31	104.16	.14	47.04
Dead spruce . . . . .	.16	53.76	.16	53.76	.11	36.96
Total	31.23	10,493.28	20.66	6,941.76	13.16	4,421.76

MERCHANTABLE AREA—SPRUCE LAND AND SWAMP COMBINED—1,032 ACRES.

Spruce	25.42	26,240.88	19.19	19,799.52	13.37	13,795.20
Balsam	5.08	5,247.36	2.64	2,723.76	.90	929.76
Hemlock	2.63	2,716.08	2.45	2,526.24	2.18	2,253.36
White pine	1.28	1,319.04	1.25	1,291.68	1.25	1,291.68
Dead spruce . . . . .	.11	116.40	.11	116.40	.10	99.60
Total	34.52	35,639.76	25.64	26,457.60	17.80	18,369.60

PINE LAND—211 ACRES.

White pine	25.96	5,477.56	25.85	5,454.35	25.62	5,405.82
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TABLE XXIX.—HARDWOODS—PRESENT YIELD—TOWNSHIP 5.
Merchantable Volume in Board Feet by Old Scribner Rule.
SPRUCE LAND—696 ACRES.

SPECIES.	CUTTING TO A LIMIT OF 15 INCHES IN DIAMETER BRESTHIGH.		CUTTING TO A LIMIT OF 17 INCHES IN DIAMETER BRESTHIGH.		CUTTING TO A LIMIT OF 19 INCHES IN DIAMETER BRESTHIGH.	
	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
	Board feet.		Board feet.		Board feet.	
Birch	4,190.55	2,916,622.80	3,560.70	2,478,247.20	2,864.55	1,993,726.80
Maple	434.85	302,655.60	239.85	166,935.60	161.85	112,647.60
Beech	425.10	295,869.60	198.90	138,434.40	113.10	78,717.60
Total	5,050.50	3,515,148.00	3,999.45	2,783,617.20	3,139.50	2,185,092.00

SWAMP LAND—336 ACRES.

Birch	1,764.75	592,956.00	1,443.00	484,848.00	1,156.35	388,533.60
Maple	35.10	11,793.60	21.45	7,207.20		
Beech						
Total	1,799.85	604,749.60	1,464.45	492,055.20	1,156.35	388,533.60

MERCHANTABLE AREA—SPRUCE LAND AND SWAMP COMBINED—1,032 ACRES.

Birch	3,400.80	3,509,578.80	2,870.40	2,963,095.20	2,308.80	2,382,260.40
Beech	286.65	295,869.60	134.55	138,434.40	76.05	78,717.60
Maple	304.20	314,449.20	167.70	174,142.80	109.20	112,647.60
Total	3,991.65	4,119,897.60	3,172.65	3,275,672.40	2,494.05	2,573,625.60

FUTURE YIELD.—On the valuation surveys the smaller trees down to five inches diameter breasthigh were counted and tallied. From the figures so obtained, by the table of the growth of spruce given in Bulletin No. 30 (page 31), and from the volume tables, an estimate has been made of the future yield of spruce on Townships 5, 6 and 41.

These figures are given in the following table, which shows for the merchantable area on Townships 5, 6 and 41 the yields of spruce expressed in standards which might be obtained after successive ten-year periods, and the number of years which must elapse before an equal cut can be had, provided that the diameter limit adopted now be adhered to then.

TABLE XXX.—ESTIMATE OF FUTURE YIELD OF SPRUCE ON MERCHANTABLE AREA IN TOWNSHIPS 5, 6 AND 41.

Volume in Markets by Standard Rule.

TOWNSHIP 5.

Cutting limit: diameter breasthigh.	Average present yield per acre.	AVERAGE CUT PER ACRE OBTAINABLE AT THE END OF 10-YEAR PERIODS IN STANDARDS.					Interval required between equal cuts.
		10	20	30	40	50	
Inches.	Standards.						Years.
10	23.08	2.70	5.66	11.72	19.35	26.18	46
12	18.76	2.72	8.34	15.15	24.43	39.19	34
14	15.36	2.54	11.33	19.75	31.13	44.71	25
TOWNSHIP 6.							
10	25.36	2.52	6.09	11.71	17.16	24.76	51
12	21.00	2.76	8.29	14.74	25.12	39.04	36
14	16.41	2.84	12.28	20.87	31.97	47.03	25
TOWNSHIP 41.							
10	32.37	2.44	5.99	12.37	20.29	27.34	56
12	27.58	2.98	9.00	15.46	26.13	41.91	41
14	22.65	3.37	13.86	23.44	34.90	50.52	29

The following table shows in percentages of the present cut for the three diameter limits what the future cuts would be in from ten to fifty years:

TABLE XXXI.—ESTIMATE OF FUTURE YIELD OF SPRUCE ON MERCHANTABLE AREA IN TOWNSHIPS 5, 6 AND 41.

TOWNSHIP 5.

Cutting limit: diameter breasthigh.	Average present yield per acre.	AVERAGE CUT PER ACRE OBTAINABLE AT THE END OF 10-YEAR PERIODS EXPRESSED IN PERCENTAGES OF PRESENT YIELD.					Interval required between equal cuts.
		10	20	30	40	50	
Inches.	Standards.						Years.
10	23.08	11.7	24.4	50.6	83.6	113.5	46
12	18.76	14.5	44.6	80.9	130.5	209.9	34
14	15.36	17.5	78.1	136.1	214.5	308.1	25
TOWNSHIP 6.							
10	25.36	9.6	23.3	44.8	65.7	94.8	51
12	21.00	12.7	38.2	67.8	115.6	179.7	36
14	16.41	16.7	72.2	122.6	187.8	276.3	25
TOWNSHIP 41.							
10	32.37	7.6	18.7	38.7	63.5	85.5	76
12	27.58	10.9	33.1	56.9	96.1	154.1	41
14	22.65	15.5	63.8	107.9	160.6	232.5	29

The total future yield of spruce to be expected from the merchantable area in Townships 5, 6 and 41 in from ten to fifty years after cutting to ten, twelve or fourteen inches is given in the following table:

TABLE XXXII.—ESTIMATE OF TOTAL FUTURE YIELD OF SPRUCE ON MERCHANTABLE AREA IN TOWNSHIPS 5, 6 AND 41.

TOWNSHIP 5.							
Cutting limit: diameter breasthigh.	Total present yield.	TOTAL YIELD OBTAINABLE AT THE END OF 10-YEAR PERIODS IN STANDARDS.					Intervals required between equal cuts.
		10	20	30	40	50	
Inches.	Standards.						Years.
10	395,853.59	46,315.80	97,091.64	201,044.88	331,929.90	449,091.72	46
12	321,742.89	46,658.88	143,064.36	259,883.10	419,072.22	672,265.26	34
14	263,456.29	43,571.16	194,354.82	338,791.50	568,312.02	766,955.34	25
TOWNSHIP 6.							
10	544,486.54	54,081.72	130,697.49	251,308.31	368,270.76	531,374.76	51
12	450,612.99	59,232.36	177,911.69	316,335.14	539,100.32	837,837.44	36
14	352,129.40	60,949.24	263,541.08	447,891.07	686,108.17	1,009,310.83	25
TOWNSHIP 41.							
10	642,810.18	48,455.96	118,955.41	245,655.83	402,939.11	542,945.06	56
12	547,802.31	59,179.82	178,731.00	307,020.14	518,915.67	832,290.69	41
14	449,892.61	66,924.83	275,245.74	465,494.96	693,079.10	1,003,276.68	29

SPECIES RECOMMENDED TO BE LUMBERED.

While figures of present yield have been given for five species, it is advised that at present only the spruce, balsam, and white pine be logged on Townships 5, 6 and 41.

PROPOSED DIAMETER LIMIT.

The proper diameter limit breasthigh which should be used can only be determined after taking into consideration several factors. A sufficient number of seed trees must be left in order to insure the reproduction of the valuable species, and the cutting must not be too severe, or the period in which an equal cut may be expected will be too long. On the other hand, the diameter limit must not be made too high or the lumberman can not get enough timber to pay for the logging.

Tables are given showing the present and future yield of spruce with diameter limits of ten, twelve and fourteen inches. A careful study of these has led to

the decision that, taking everything into consideration, twelve inches breasthigh is the proper limit. This will give a large enough cut on all the townships so that there will be a safe margin of profit in the logging operations and at the same time plenty of seed trees will be left and the period of waiting for a second crop will not be too long.

Balsam is relatively less important than spruce, and the question of future yield is not so vital. The point to be decided is, rather, what diameter limit will give that percentage of balsam in the total cut which is commonly allowed in logging contracts.

Fifteen per cent has been the common rule, but with the decrease in the supply of spruce, balsam is bound to be more eagerly sought as a substitute. Cutting to a diameter of ten inches will give a percentage of twenty-two per cent on Townships 5 and 6, and fifteen per cent of the spruce on Township 41. Hence, ten inches seems to be the ideal cutting limit for balsam.

The white pine on Townships 5, 6, and 41 is comparatively scarce, but is of large size and good quality. By cutting to a diameter limit of fourteen inches many seed trees will be left, but all the mature trees removed. This will give the following proportion of pine, compared with spruce, on the townships: Township 5, one and one half per cent; Township 6, two per cent; Township 41, four and one half per cent.

It should be distinctly understood that the diameter limits are not arbitrary figures, but are merely intended as a guide for the man who marks the timber. For example, where the stand is thin it will be advisable to leave trees over the diameter limit in order to provide seed, and in too dense stands smaller trees should be marked. In general, the amount cut on one side of the limit will equalize that left uncut on the other side.

REMAINING SPECIES.

Whether or not the remaining species of commercially important trees on the block should be logged in connection with those recommended to be cut, depends very much on the manner in which the block is to be managed.

It is recognized that great benefit would result to the young trees of the more valuable kinds if the larger hardwoods were to be removed, and that, if this were done, the general productive condition of the forest would be bettered. But, on the other hand, it would not be expedient as a business proposition to recommend the logging of these species, unless conditions were more favorable than they are at present.

PART II.

Lumbering Plan

Introduction.

In studying this lumbering plan for Townships 5, 6 and 41, it should be borne in mind that the greater part of all the timber on these townships is naturally tributary to Raquette Lake in the center of Township 40, and, from a lumbering view-point, this fact so closely binds together all four townships that this plan may properly be called a supplement to the one already made for Township 40.

There are a number of small watersheds within the limit of these three townships, however, from which the timber, although naturally tributary by stream descent to other waters than Raquette Lake, could be brought back to this timber center without any very great additional cost. The several advantages mentioned in the preceding report on Township 40, such as the railroad facilities for bringing supplies, men, etc., steamboat lines, telegraphic and telephone conveniences for making possible a quick connection with a purchasing point, apply in a degree to Townships 5, 6, and 41. Raquette Lake railroad station (Durant), being very nearly in the center of the four townships, would furnish an advantageous location for a general lumbering headquarters for distributing supplies, paying men, etc.

This plan has as its object the best interests of the people of the entire State. In it is included all such information and recommendations necessary to facilitate the removal of the timber in the cheapest manner possible, and only such improvements are recommended as will materially add to the price which the State would ordinarily receive for its stumpage.

It is not necessary that branch railroad tracks or mills should be made a permanent feature, or that the parties constructing them should be granted a charter for an unlimited length of time. Permission to make these improvements should be granted only on condition that any unnecessary damage should be deemed a sufficient reason for discontinuing the charter. Then, if the operations in and around the mill, or on the railroad branches, were not being performed in a satisfactory manner, or in compliance with the regulations governing their use, they could at once be summarily stopped by the State authorities without recourse to litigation.

NATURAL OUTLETS FOR TIMBER.

The timber in the northern and western parts of Township 41 is naturally tributary to the North Branch of the Moose River via Big Moose Lake and the streams discharging their waters into it. The timber in the southern and western portions of Township 5 is tributary by natural outlet to the North and South Branches of the Moose River, and a small portion of the timber in Township 6 is also tributary to the South Branch of Moose River via Silver Run and the outlet of Lake Kora.

The timber in the southern and eastern parts of Township 6 (given a distinctive color on lumbering map) can be taken either to the Cedar River through Wakeley Brook or it can be brought to Raquette Lake by making a long haul to South Inlet. The timber around Eighth and Seventh Lakes in Township 5, although naturally tributary by water course to the North Branch of Moose River through Fulton Chain of Lakes, could be most cheaply and economically brought out upon a branch railroad track connecting with the main line of the Raquette Lake Railway near Brown's Tract Pond (see lumbering map) either to Raquette Lake or outside points for manufacture, or be driven down below the lake. This timber could all be hauled by team direct to Raquette Lake, but it would necessitate a long and costly log haul. If one party purchased all the timber in this compartment it would be more economical to take the timber out on cars. It could then be taken out just as it was desired for manufacture at Raquette Lake or elsewhere.

One of the main outlets for all this timber, and one of the greatest advantages to the lumbermen, is the Raquette Lake Railway, which furnishes facilities for bringing in supplies, outfit, men, etc., and at the same time opens up for a purchaser whose manufacturing plant might be located in some distant part of the State a possible means of transporting logs or timber to his plant for manufacture, and thereby gains for the State the advantage of additional bidders for the stumpage. By the construction of branch tracks the greater part of the timber on these four townships can be taken out by rail either in a manufactured or rough state. Such an additional outlet cannot fail to add to the value of the stumpage on these tracts, and it is certainly a wise policy to allow improvements to be made that will so materially advance the prices of the timber stumpage on so large a tract as the one under consideration.

DIVISION OF TOWNSHIPS INTO COMPARTMENTS.

In formulating this working plan it has been considered advisable, for the purpose of estimating the stand of timber, to divide the townships into compartments based upon natural lines, which take in the timber standing in each watershed. The boundaries of each compartment are defined by the height of land. The divisions between the separate watersheds are shown upon the lumbering map by broken lines. Because there are many different compartments from which the timber, if it were taken down the natural water courses, would go to widely diversified markets, each compartment will be spoken of separately. A brief statement of the conditions existing on the different compartments and the most advisable methods of removing the timber follow. Attention is invited to the data shown upon the lumbering map for the purpose of conveying more clearly to the lumberman a thorough understanding of the different compartments. The following is a list of the compartments:

- No. 1. Shallow Lake Compartment.
- No. 2. Seventh and Eighth Lakes and Brown's Tract Pond Compartment, Townships 5 and 41.
- No. 3. South Inlet Compartment.
- No. 4. Bear Pond Compartment, in Township 6.
- No. 5. Cedar River Compartment.
- No. 6. Silver Run Compartment.
- No. 7. Sumner Stream Compartment, Townships 5 and 6.
- No. 8. Bear Pond and Red River Compartment, Township 5.
- No. 9. Fourth Lake Compartment.
- No. 10. Big Moose Compartment.

No. 1. SHALLOW LAKE COMPARTMENT.—The natural outlet by water for all the timber in this large compartment, as well as the timber in the southwesterly portion of Compartment 5, Township 40, to Raquette Lake is by way of the outlet of Queer Lake, Shallow Lake and Sucker Brook. If it was intended to take the timber out by way of Raquette Lake, it would be advisable to so improve the streams that the timber could be driven direct into a large storage boom located in the west end of Sucker Brook Bay. In order to make it possible to drive the streams, it would be necessary to construct a small flood dam on Township 40, near the head of the rapids between Raquette Lake and Cranberry Pond at the point shown on the lumbering map. It would also be necessary to improve the stream between Raquette Lake and Cranberry Pond by blasting out

some rocks, cutting the small brush in the flow near Raquette Lake, and making cuts across some of the crooked bends in the stream. Another small dam would need to be constructed on the outlet of Shallow Lake at the point designated on the lumber map as an available site for a dam (see map). Some improvements would also be necessary on the stream between Shallow Lake and Cranberry Pond before logs could be driven from Shallow to Raquette Lake.

If all the stumpage in this watershed was purchased by one party, the improvement of this stream would furnish the cheapest means of getting the timber to Raquette Lake. If the recommendations made in the working plan of Township 40 were carried out, it could be manufactured at this point and shipped out by rail, or driven down stream to the markets on the river below.

The timber in the western part of this compartment, along the line of Townships 41 and 8, is naturally tributary to Raquette Lake by way of the outlet of Queer Lake. The improvement of the streams and construction of dams need not necessarily do any injury to the timber standing along the shores of the lakes or streams, as log driving for this short distance should be finished before the leaves commence to come out on the trees. With a properly constructed dam, built with the trip-sill and bed-pieces of the sluice low enough so that the water would not be raised above its normal height in the lakes when the dam was open, the danger of flooding the roots of the standing trees would be avoided. No improvement of streams or construction of dams should be allowed, however, except under the direct supervision of an inspector competent to determine whether or not the work is being carried out as first specified.

There is a very small amount of timber near the west line of Township 41, in the Cascade Lake drainage, which would require some up-grade hauling in order to bring it to Shallow Lake, but the grade is not sufficient to cause any serious difficulty in bringing the timber over the divide.

If only the timber on this compartment in Township 41 was purchased, and it was to be shipped by railroad to some point for manufacture, it could be hauled to Shallow Lake, and a branch track from the Raquette Lake Railway to Shallow Lake constructed, leaving the railroad at the same point as the branch advised to Sucker Brook Bay (see working plan of Township 40), and turning from that route to Shallow Lake near the point where the trail from Shallow Lake to Lower Brown's Tract Pond connects with the old Sucker Brook wagon road (see lumbering map). This would save the expense of driving timber from Shallow Lake to Raquette Lake. Some up-hill hauling would be necessary in bringing the timber from around Cranberry Pond to Shallow Lake, but the grade is light.

Jack works could be erected at Shallow Lake for loading the logs upon cars. There is a wide marsh, as shown on the lumbering map, which it would be necessary to cross, but nothing to prevent the construction of a branch railroad track if it was desirable to take the timber out this way. All the timber around Pelcher and Haymarsh Ponds and Queer Lake would naturally come into Shallow Lake with a short and cheap log haul. The natural snow and watershed of Queer Lake is so small that it would not be advisable to attempt to drive logs in the stream above the head of the still water above Shallow Lake. The only improvement which would be necessary on the stream above this point would be to clear out some of the old slashes in the creek between the head of boat navigation and Queer Lake, for the purpose of giving the water a free and unobstructed flow. Logs could well be landed on the still water of the level above Shallow Lake, and be driven down into Shallow Lake on the first freshets in the spring. If they were to be driven to Raquette Lake, there should be a sufficient force of men employed on the drive to keep the logs running down the outlet of Shallow Lake, through Cranberry Pond, and so on out into Raquette Lake, in order to finish up the log driving and leave the water at its natural height before the leaves come out on the trees, and thus prevent flooding the roots of the trees.

All the timber in this compartment in Township 41 which is in the Beaver Brook drainage can be taken without great expense, by any one of three routes. It can be hauled down Beaver Brook and landed in the storage boom at Sucker Brook Bay, as there is a level swamp reaching from Sucker Brook Bay to Beaver Brook, across which the logs could be hauled without any up-grade (see lumbering map); or it could be hauled across to Shallow Lake and driven down the outlet into the same bay on Raquette Lake; or if it was desired to take it out by rail, it could, by slight up-grade hauling, be brought to the Raquette Lake Railway at Upper Brown's Tract Pond. The railway runs near the south shore of Upper Brown's Tract Pond, and by putting in a siding here, a steam jack works could be utilized for loading all the timber in the upper end of the Beaver Brook Valley from the pond, onto cars at this point. In addition a large amount of other timber on the tract could be cheaply hauled by team to this point. The advisability of doing this would depend, of course, upon the parties who purchased the timber, and the direction in which it was to be taken. A glance at the contours upon the lumbering map will show that any one of these routes is feasible, although differing as to cost.

NO. 2. SEVENTH AND EIGHTH LAKES AND BROWN'S TRACT POND COMPARTMENT, TOWNSHIPS 5 AND 41.—The timber in this compartment is all tributary either to

the North Branch of Moose River via Seventh and Eighth Lakes and Fulton Chain of Lakes or to Raquette Lake via Brown's Tract Inlet. The timber situated north of the divide or watershed between the Fulton Chain of Lakes and the Brown's Tract Inlet could be taken to either Raquette Lake or to the Raquette Lake Railway at Upper Brown's Tract Pond by having some slight up-grade hauling from the extreme western portion of the compartment, near the west line of Township 41 (see lumbering map).

The timber which is tributary to Seventh and Eighth Lakes could most cheaply be delivered to market by constructing a branch railway track from the Raquette Lake Railway, on the line shown on the lumbering map, to the northeastern part of Eighth Lake, erecting steam jack works there for loading logs from the water to cars. The timber naturally tributary to Seventh Lake could be hauled in the winter to the south end of Eighth Lake, landed upon the ice there, and floated in the spring through the lake to the point where the proposed railroad branch touches the northeastern end of the lake. The particular reason for bringing the branch railroad to the northeastern end of the lake is that the prevailing Adirondack winds in the spring have a tendency to move logs and floodwood to the north and east shores of lakes. A study of the greater accumulations of driftwood in those portions of the Adirondack lakes will furnish convincing proof of this statement.

The timber in this compartment in the Seventh and Eighth Lakes watershed could all be hauled with teams to Raquette Lake or Upper Brown's Tract Pond, but this would necessitate a long and very costly log haul, and would consequently cause a lower price to be offered for the stumpage. All the timber in this part of the compartment is naturally tributary by water course to the North Branch of the Moose River via Fulton Chain of Lakes, but as the Fulton Chain of Lakes have been used for years as a public highway for steamboat navigation, and as there are some very narrow passages between the different lakes, the stream between First Lake and Old Forge would inevitably become blocked by logs if they were taken this way. Moreover, all this timber would have to be towed a long distance through the lakes by steamboat, and the booms would have to be opened and the logs slowly worked through the narrow passages, a method involving a considerable expense to the lumberman and no small damage to many other interests. It would therefore be better to remove this timber by a branch railroad constructed from Upper Brown's Tract Pond on the Raquette Lake Railway to the northeastern end of Eighth Lake.

The Upper Brown's Tract Pond would furnish an excellent point upon which to land the logs on the ice in winter from the Brown's Tract Inlet portion of

this compartment, if they were to be taken out by rail. A small plant could be located at this point for the generation of electric power for operating the branch railroads, for loading logs upon cars, or for a manufacturing plant, if the timber tributary to this point were all sold to one party. The Raquette Lake Railway passes near the south shore of the Upper Brown's Tract Pond. A siding could be cheaply and easily constructed here for the purpose of loading logs or timber upon cars. Most of the timber in the Beaver Brook Valley could be hauled to this point by team if desired.

No. 3. SOUTH INLET COMPARTMENT.—All the timber on this compartment can be taken, most easily and cheaply, direct to Raquette Lake by the natural water courses.

The greater part of the timber is naturally tributary to South Inlet, one of the main feeders to Raquette Lake, and the outlet of Sagamore and Mohegan Lakes. The timber tributary to this stream could be driven from the line of the private land, near the head of the still water, down into Raquette Lake. The absence of driftwood along the sides of this stream convinces the observer that the spring freshets and the prevailing winds would drive the timber down this stream and out into the lake. Logs could be landed along the marshes on the sides of the stream. It would be advisable to cut down the small, dead timber standing along the shores of South Inlet, much of which has been killed by the water being held at too high a level, in order that the free passage of logs down the stream in the springtime, when the marshes are flooded, should not be hindered. The removal of the dead timber would be an improvement to the appearance of the stream rather than a detraction, as the dead timber is one of the most unsightly features along the banks.

A catch boom hung across the mouth of the stream at its entrance to the lake would prevent the logs from being scattered around the shores of the lake.

When the logs had been driven out of the inlet, the boom could be closed and swung around into the right-hand bay, away from the mouth of the stream, if it was desired to store them there for a while; or they could be towed by steamboat to the foot of the lake, to Sucker Brook Bay, or to any point to which it was desired to take them for further driving, loading on cars, or manufacturing. The work which would necessarily be done on this compartment for the purpose of making it possible to remove the timber quickly and cheaply, if properly carried out, need not detract in any way from the beauty of the scenery. Were it permissible to construct small flood dams upon the Mohegan and Sagamore Lakes, the more distant timber could be very easily and cheaply driven from the junction of the two streams (outlets of Mohegan and Sagamore Lakes) directly

into Raquette Lake, thereby very materially shortening the log haul for the timber in the extreme distant points of this compartment; but as these lakes and streams are owned by private parties and used as private preserves, it is not probable that the construction of dams or the improvement of streams would be allowed, although if the water was properly handled no appreciable damage to the timber standing on the shores of the lakes need be done.

Much of the timber included in this compartment would of necessity be compelled to pass through these private tracts in order to reach Raquette Lake, necessitating the constructing of a log road across them. The timber tributary to Death Brook in Township 6, on the east side of South Bay, would naturally be landed in the lake, near the outlet of the brook, and could be stored in booms at that point. The timber tributary to the branches of Otter Brook and Brown's Tract Inlet could easily be landed in Otter Bay, where it could be boomed and held until it was desired to remove it, without in any way interrupting steamboat navigation or tourist travel.

All the timber in Cedar River Compartment (see lumbering map) could be brought to Raquette Lake via the inlet and outlet of Sagamore Lake, if it were deemed advisable to do so, but it would all have to pass through the Sagamore private preserve, and all timber above Mohegan Lake, if brought to Raquette Lake, would have to pass through the Mohegan private preserve. The question of hauling or driving logs through these or any other private properties can not be discussed here. That is a matter for owners of private property and the proper State officials to decide.

NO. 4. BEAR POND COMPARTMENT, IN TOWNSHIP 6.—The greater part of the timber on this compartment is naturally tributary to Raquette Lake by way of the outlets of Bear Pond and Slim Pond and thence down the Marion River. This stream, however, is the main thoroughfare for navigation by steamboats and rowboats, and as navigation begins as soon as the ice goes out in the spring there would undoubtedly be a great deal of just opposition to the driving of logs from the many interests which use this river as the only feasible means of travel between Raquette Lake and Blue Mountain Lake. Another reason why it would not be advisable to drive the timber down the Marion River is that the south and west winds, which usually prevail in the spring, blow directly up the bay and into the mouth of the river, and might seriously hamper or prevent the log driver from getting his logs down to the mouth of the river and properly confined in booms in the lake.

Because of these facts it would be cheaper for the lumberman and more satisfactory for all concerned to haul logs or timber—not only from this com-

partment but also that in the eastern portion of Compartment 4, Township 40—direct to Silver Beach in South Bay, where there is a good storage area. Here the logs could be safely boomed and held without in any way discommoding travel or navigation.

In the case of this compartment, however, owing to the ease with which it can be reached from Marion River carry by supplies and men, all of the timber upon it which it is considered advisable to remove would undoubtedly find ready purchasers. There is a small sawmill located at the west end of the Marion River carry, near the line between Townships 6 and 34, which manufactures lumber, laths, shingles, etc., for local trade. The owners of this mill would probably be willing to pay as much for the stumpage on this compartment as it is worth, as this timber could be more easily and cheaply brought to their mill than any other which is available, and it would furnish them a sufficient stock for some time. If the stumpage could be disposed of in this way, it would bring in the largest returns with the least amount of labor.

NO. 5. CEDAR RIVER COMPARTMENT.—The timber standing on this compartment is very peculiarly situated. The topography is such that the timber can be taken out by either one of two directions. It can be hauled via Wakeley Brook to the Cedar River, which outlets into the Hudson River, or it can be taken through Sagamore Lake and South Inlet to Raquette Lake, the waters of which flow north and discharge into the St. Lawrence River. All of the timber on this compartment can without difficulty be taken to either of these streams, discharging their waters in opposite directions.

The mature spruce and pine on the greater portion of this compartment was cut and removed about seventeen years ago. At that time the lumbermen who removed the timber were cutting their logs no smaller than a nine-inch top diameter limit, and were taking only trees that would furnish two logs. Since this timber was removed there has been such a decided increase in the rate of growth of the remaining trees of these species that to-day the stand of timber on this compartment nearly equals that on other portions of the township from which no timber has ever been removed. The timber formerly removed from this compartment was taken to Glens Falls via Cedar River for manufacture. The old log roads are still easily traced and show very plainly the direction and route by which the timber was taken to market. There is nothing to prevent any or all of the timber in this compartment from being taken out either way. In order to distinguish the boundaries from which it would be possible and advisable to remove the timber in either direction, the compartment lines have been given a distinctive coloring on the lumbering map. There could be more timber taken in either

direction than is indicated by the coloring by "slabbing" the sides of the mountain. The outlines are given just as the division would naturally occur. The removal of the timber by the Cedar River route offers the shortest and cheapest log haul to a point from whence the timber could be floated. The route via Sagamore Lake to South Inlet, from whence the timber could be driven to Raquette Lake, is much longer. In the northern and western portions of the compartment the timber which was formerly removed was "slabbed" across from the stream on which the Fish Creek camp is located to the Big Marsh (see lumbering map), thence across this wide swamp or marsh, over a slight divide between the two watersheds and down the Wakeley Brook to the Cedar River. This same method would have to be applied in bringing timber from the Wakeley Brook drainage back across to the Raquette Lake waters.

It is something very unusual for as large a tract as this compartment, which comprises all the territory lying in between the Blue Ridge Mountains on the north, the Wakeley Mountains to the south and east, and Bradley Mountains to the west, to be so situated that the timber standing upon it can be taken equally well, in different directions, to streams whose general water courses are so nearly diametrically opposite. This peculiar feature affords an opportunity of selling the stumpage to any one of the many different manufacturers of lumber and wood pulp located on the Hudson and Raquette Rivers.

NO. 6. SILVER RUN COMPARTMENT.—The timber in this compartment, which is located in the extreme southwest portion of Township 6, and comprises all the watershed between Bradley Mountain and the Wakeley Mountain range, is naturally tributary by water course to the South Branch of the Moose River via Silver Run. Moose River has been improved for the purpose of driving logs above this point, and the lumbermen would experience no serious difficulty in driving logs from this compartment down Moose River to the railroad or mills located on the stream below. The branch of Silver Run down which these logs would have to be sent does not contain sufficient water to float them. It would be, therefore, advisable to haul them direct to the South Branch of Moose River. On account of the inaccessibility and smallness of this compartment, the long distance which supplies would have to be hauled in order to remove the timber, and the long haul necessary to get the logs to the stream whence they could be driven, a large stumpage price can not reasonably be expected. It would be advisable to sell the stumpage on all the compartments which are tributary to the South Branch of the Moose River in one sale to one party, if possible, since by decreasing the cost of log driving by furnishing a larger number of logs to be driven it is probable that an increased price for the timber

would be offered. It would hardly pay to make this long and costly log drive for one small job, as it costs but little more to "pick the rear," or gather up the logs hung up on the banks and formed in the side jams along the rapids, behind a drive of 50,000 standards, than it does to gather up the rear for a drive of 20,000 standards, and the cost of driving a small amount of logs is proportionately much greater per standard than the cost of driving a large amount.

NO. 7. SUMNER STREAM COMPARTMENT, TOWNSHIPS 5 AND 6.—The timber on this compartment is naturally tributary to the South Branch of the Moose River via the Sumner stream. This compartment takes in a portion of the timber along the south and east line of Township 5, together with the timber in Township 6. The Sumner stream (outlet of Lake Kora) has been improved for the purpose of driving logs from its mouth where it connects with the South Branch of the Moose River to a point about four miles below Lake Kora. A number of years ago much of the pine which formerly stood on Township 4 was driven down this stream into the Moose River, and so on down to Lyons Falls. The foundations and frameworks of several of the old flood dams which were erected at that time are still in evidence along the stream. One of these dams was built on what is now private land, on the outlet of Lake Kora, a short distance below the lake. All the land and timber around the shores of Lake Kora is private property (see lumbering map), and in removing timber from this compartment it would be necessary to cross some portions of this private tract, though appreciable damage need not result.

The water outlet, however, is the natural and most advisable one for removing the timber from this compartment. But the amount of timber of the diameter limit standing on this compartment which it is advised to remove is not large enough to justify the unavoidable expense necessary to erect dams and otherwise improve the Sumner stream sufficiently to make log driving possible unless there was more timber to be driven down it than is included in this compartment. There is considerable timber standing on Township 4 which is tributary to this stream, but which is not included in this working plan. If this timber was included and removed in succeeding seasons, it would be advisable to make and maintain such improvements on the stream that logs could be driven down into the South Branch of Moose River.

It would also be possible, if desired, to take all of the timber on this compartment through into the South Inlet Compartment, and down to Raquette Lake via Mohegan Lake outlet, as there is low land extending through from Lake Kora to Mohegan Lake, with a gradual descent to Mohegan Lake soon after leaving

Lake Kora (see lumbering map). Logs could be hauled by this route, without having any serious up-grade, to the head of the still water on South Inlet, whence they could be driven into Raquette Lake. The log haul by this route would necessarily be a very long one, and would also have to pass through the private property which includes all of Mohegan Lake and the land and timber lying immediately adjacent (see lumbering map). There would be no necessity for causing damage or in any way impairing the usefulness and beauty of either of these private properties, further than the unavoidable constructing of log roads for the purpose of hauling the logs in winter. Roads around the lakes on either of these private preserves need not be cut, as the logs could be hauled across them on the ice in winter.

NO. 8. BEAR POND AND RED RIVER COMPARTMENT, TOWNSHIP 5.—The timber on this compartment is tributary by waterflow to the South Branch of the Moose River via Benedict Creek and the Red River. Timber from this tract would have to be hauled a considerable distance along the banks of these streams, as they do not contain a sufficient quantity of water to float logs, except for a short distance near their junction with the South Branch of the Moose River. This long haul would necessitate a slight reduction in the stumpage price which could ordinarily be obtained for this timber, as it is an unalterable rule that the lumberman cannot afford to pay as much for timber which costs him one dollar a standard to deliver on some stream, whence it can be driven to his mill, as he could if it cost him eighty or ninety cents. These points should always be taken into consideration by those who have charge of selling the stumpage on the different compartments or tracts. The descent of these streams is very steady and regular, and excellent log roads can be cheaply constructed the entire distance from their sources to their junction with the South Branch of Moose River. Log roads have already been constructed a considerable portion of the distance outside the lines of Township 5 on both streams. These would lessen the primary cost of constructing the main winter roads for hauling logs. The timber stumpage of the species advised to be removed from this compartment will undoubtedly find ready purchasers among the lumber or pulp manufacturers whose mills are located on the stream below the junction of these streams with the Moose River. Moose River has been improved for log driving purposes to a point above where any of the timber from this tract would naturally be landed, and log driving upon the South Branch of the Moose River has been conducted for many years by different lumber companies whose plants are located on the stream below.

No. 9. FOURTH LAKE COMPARTMENT, TOWNSHIP 5.—The small amount of timber included in this compartment is tributary to the eastern end of Fourth Lake, one of the Fulton Chain of Lakes. This timber could be taken to the Raquette Lake Railroad and loaded upon cars at Eagle Bay, as some of the timber standing directly alongside of it, on the west side of the west line of Townships 5 and 41, has already been taken out that way; or it could be taken over the divide and to Upper Brown's Tract Pond. It could also be very cheaply and easily taken to the small mill located near Fifth Lake, and the stumpage would probably find ready purchasers in the owners of this mill to supply the local demand. Good log roads have been constructed directly up to the west line of Township 5, leading to both of the points mentioned, and, although this compartment is small, it is thought that the stumpage could be very readily disposed of for its full value, on account of its convenience to these points for manufacture or shipment. There is not a sufficient quantity of timber standing on the compartment to warrant any great expense for removal, and if it could be sold to the local manufacturers for a reasonable price this would be the best way to dispose of it.

No. 10. BIG MOOSE COMPARTMENT, TOWNSHIP 41.—The timber standing on this compartment is all tributary to the North Branch of the Moose River via Moose Lake. If this tract were lumbered, and the timber taken out by waterway, it would have to pass through Big Moose Lake, and so on down to some of the manufacturing establishments below. The high hills surrounding the compartment make an attempt to take any portion of the timber to Raquette waters inadvisable, except perhaps a small portion near Otter Pond. Even this would have to be taken up over a very heavy grade, and could undoubtedly be removed cheaper by hauling down the stream. The timber standing in this watershed in Compartment 6, Township 40, could go the same way.

The timber could best be taken out by being hauled directly to the eastern end of Big Moose Lake. It would be possible to drive logs down the outlet of the Lower Sister Pond into Big Moose Lake by improving the stream for that purpose and erecting a flood dam at the outlet, but it would not be advisable to do this for the comparatively small amount of timber tributary to these ponds. The hauling distance is short, and when the logs are once loaded on the sleighs, if they are to be driven down the stream below Moose Lake, it would be better to haul them directly to the lake and land them on the ice, inclosing them with booms to keep them from being scattered when the ice breaks up. They could be started down the lake in the early spring, as soon as the ice went out, without having to wait until they were driven down the Two Sisters stream, thereby

gaining the advantage of having all the natural spring floods to assist in driving them down the stream below Big Moose Lake. There is, as shown by the estimate, a large amount of mature timber standing on this compartment which should be removed. There would undoubtedly be considerable opposition to timber being driven down through Big Moose Lake and the stream below. It is not in the province of this working plan to discuss objections to the right to float timber here or elsewhere. Such questions can only be properly settled by the State Legislature, but as this is the natural and most advisable way to remove the timber from the compartment, the only thing possible to do in this plan is to advise that it be so removed. If the right to drive the timber down through the lake and its outlet to the mills below, or to some point where it could be loaded on cars for shipment, were guaranteed, the stumpage would undoubtedly find purchasers at a fair price. The timber in Compartment 6, Township 40, should also be included in this sale, it being naturally tributary to Big Moose Lake. While the whole compartment is generally hilly or mountainous, the beds of the streams are comparatively smooth, and would furnish an opportunity for the construction of good main log roads with a steady down grade for hauling the logs from the extreme points of the compartment to the lake. The stand of timber of the species advised to be removed is exceptionally good, thereby compensating, in a measure, for the roughness of the territory.

SALE OF STUMPAGE BY THE STATE.

The mature timber on the townships may be logged by the State or the stumpage sold to private parties.

State or governmental organizations are generally unable to carry on large commercial enterprises as economically as private companies. If the State should do its own logging on Townships 5, 6 and 41, a large and expensive logging outfit would have to be purchased, camps and dams erected, and a big force of clerks, foremen, and lumber jacks employed. The private company, on the other hand, would have its outfit on hand and its organization for doing such work completed. The State would secure just as much profit if the stumpage were sold to private parties, and in addition be saved the annoyance of collecting an efficient logging outfit. The demand for spruce, balsam, pine and hemlock is so strong in this section that competition among manufacturers would force the price offered up to very nearly the true value of the stumpage.

EFFECT OF THE ADVISED IMPROVEMENTS UPON STUMPAGE VALUES.

The prices which the purchasers can afford to pay for timber stumpage depend upon existing conditions on the tract from which the timber is to be removed. The topography of a tract, length of log haul, length and cost of log drive, distance which the timber would have to be transported upon railroads, market prices, cost of supplies, price of labor, and other points too numerous to mention, all have a direct bearing upon stumpage prices. Particular attention is directed to these facts, as it is only for these reasons that the different improvements on streams, the construction of dams, and the allowing of the erection of a manufacturing plant at Sucker Brook Bay, and the construction of branch railroad tracks for removing the timber cheaply, are advised.

Every cent taken off the cost per standard of removing the timber from a tract means that the purchaser can afford to pay an additional cent per standard for the stumpage. This general rule applies in different degrees to all the compartments in these townships, and in fact to any tract where the necessary improvements for removing timber cheaply and economically have not already been made.

If the purchasers of the timber stumpage on a compartment, a township, or the whole tract, were guaranteed by the State the right to make such improvements as are absolutely necessary in order to aid them in marketing the timber in the cheapest and most economical manner, subject to certain reasonable regulations, they would be justified in paying more for the timber stumpage on the different tracts than they would be if they were compelled to haul with teams all the distant timber on these tracts to some point where it could be landed upon streams already improved for driving. As shown in the working plan for Township 40, there is no more room in the small bay at Durant than is absolutely necessary for the maneuvering of steamboats in effecting landings and carefully and safely handling freight and passengers. The manufacturing of logs into lumber at this point, or loading timber on cars for transportation, would cause a great deal of confusion and clashing of rival interests which it is entirely unnecessary to have. Otter Bay could be utilized for the purpose of loading logs on cars, or manufacture, and would furnish a considerable amount of storage for timber or logs, but a branch railroad would also have to be constructed here, and it is not as convenient or as desirable a location as Sucker Brook Bay (see lumbering map).

The construction of the advised branch railroad from Brown's Tract Pond to Sucker Brook Bay would do away with the clashing of rival interests and confusion at Durant, and at the same time remove the direct appearance of lumbering operations from the regular route of summer travel. All the timber tributary to

Raquette Lake from the different townships could be loaded upon cars or manufactured at this point on Sucker Brook Bay, as fully described in the report on Township 40. It is believed that this arrangement would be the most satisfactory to all concerned.

The most economical manner of marketing the timber in the Shallow Lake Compartment, Township 41, and the timber in Compartment 5, Township 40, tributary to Sucker Brook, would be to drive it direct to this point for manufacture, shipment or further driving. All timber coming into Raquette Lake from Townships 5 and 6 via South Inlet could readily be towed to this point, or to the foot of the lake, without in any way interfering with other interests.

The timber naturally tributary to Seventh and Eighth Lakes would be greatly lowered in value to the purchaser if the State were to insist that it should all be removed by team, since this method would add materially to the cost of removing the timber, and therefore reduce its value to the purchasers.

A glance at the lumbering map will show that the advised railroad branch to Eighth Lake is connected with the main line at Brown's Tract Pond, at the same point at which the branch track advised to be constructed from there to Sucker Brook Bay leaves. This would make it possible to use the separate railroad branches advised as one continuous railroad line. Electric power would be the best for hauling cars of logs or lumber on the branch lines. One electric track motor could handle all the loads of logs, do the necessary shifting, and haul the loaded cars of manufactured lumber out from Sucker Brook Bay to the main line of the Raquette Lake Railway. The use of electricity for the motive power reduces the danger of forest fires being started to the minimum, when compared with the use of steam locomotives. Should steam locomotives be used, they should not be allowed to burn coal or wood, except in the winter when the ground is covered with snow. Oil should be used for fuel at all other times. The use of electricity as the motive power for operations upon any railroad branches in the State forest is strongly advised.

If timber tributary to Raquette Lake were to be manufactured at Sucker Brook Bay, in a mill located there, or shipped to some distant point for manufacture, it would be good policy in either case to construct these branch tracks.

It might be considered advisable to locate a plant at the west or Upper Brown's Tract Pond for the manufacture of all the timber tributary thereto by railroad branches. A mill there could take in all timber in Compartment 1, Township 41, tributary to Shallow Lake, and the timber in Compartment 2, Townships 5 and 41, tributary to Seventh and Eighth Lakes and Brown's Tract Inlet by branch railroad tracks. All this timber could be very readily brought to this

point for manufacture by team and rail. There should be a slight difference in freight rates between this point and Raquette Lake and the New York Central Railroad at Clearwater Junction.

Considered as a general proposition, however, it is most advisable to allow the construction of a mill at Sucker Brook Bay for the manufacture of the whole amount of mature timber tributary thereto.

The stumpage on these tracts should be disposed of in one of three ways: Either by selling the timber to be manufactured at a mill erected as advised at Sucker Brook Bay; by selling the timber to parties and by them to be driven down the different streams to points of manufacture; or by selling the timber to parties and by them to be taken out on the railroad to other points for manufacture.

The consolidation of several compartments in one sale would have a tendency to cause better work to be done in removing the timber, since the greater the amount involved in a possible loss from non-observance of the rules or violation of the contract the more careful the contractors would be to see that no unnecessary damage was caused to the forests.

No timber can be driven from Raquette Lake to the mills located on the Raquette River below, unless the improvements and the erection of a dam at the foot of the lake are allowed.

If the improvements advised in the working plan for Township 40 for the purpose of making it possible to drive timber down the Raquette River to the many markets below were not made, or the right to make them and use the stream for that purpose guaranteed by the State, this alone would effectually bar all prospective bidders who have large plants located upon the stream below from taking the timber to their mills in the cheapest and most economical manner. Any improvements of this kind which can not fail to have a decided effect upon stumpage prices should certainly be allowed.

The timber stumpage upon Townships 5, 6 and 41, excepting some small portions which are advantageously located for lumbering cheaply, is not worth as much per standard to the purchasers as the timber upon Township 40, even if the improvements advised were allowed to be made, for the reason that it will cost the parties removing this timber more per standard to bring it to some convenient point for manufacture or shipment. It is obvious that where a tract to be lumbered is distant from the base of supplies it is more costly to get in the necessary supplies for performing the work.

Special attention is directed to these points, as it is only for the reason that the improvements advised would add very materially to the prices which the State could expect to receive for the stumpage that such recommendations are made.

Reasonable and necessary improvements which will add greatly to the value of the timber stumpage and which will not seriously impair nor injure the forests in either beauty or usefulness should be allowed in order that the highest prices may be received for the stumpage to be disposed of.

The stumpage values of all the timber in the Adirondacks have been steadily increasing for some years. This is especially true of spruce and pine, because of the increased demand for spruce pulpwood and the consequent enforced use of pine or other material for lumber. Average stumpage prices cannot be quoted in this work because they are constantly fluctuating, and the prices which can be expected for the stumpage upon these townships, when disposed of, will depend largely upon the action which is taken by the State in regard to the necessary improvements.

Balsam has long been included with spruce stumpage for wood pulp, at the rate of about fifteen per cent, and it should be sold with the spruce, cutting to the diameter limits advised.

RULES GOVERNING LUMBERING OPERATIONS.

A careful application of the following rules will provide for the safety and well being of the forest. If they are thoroughly enforced, the chief functions of the forest in conserving and regulating the waterflow and their use as a public recreation ground and natural sanitarium will not be impaired, nor will their capabilities as a producer of lumber be decreased.

In order that there can be no possibility of the lumberman's misunderstanding what trees should be cut and what trees should be left standing intact, it is necessary to mark all trees intended for removal. Trees smaller than the diameter limit advised which show unmistakable signs of decay and premature death but which are still merchantable, or trees whose tops have been broken off by falling trees or severe wind storms so that it is clearly apparent that they will not survive, should also be marked for removal. Any spruce, pine or balsam trees whose branches are so interlocked with valuable hardwoods or other species that they can not be removed without cutting the latter should not be marked. These can be taken when the other species are marketed.

The diameter limits advised for guidance in the removal of the mature timber have been fixed after a careful and thorough study of the effect of such removal on the forest and the profits to be expected from the lumbering. Upon the care with which the tree markings are made and the thoroughness with which the rules governing the lumbering are carried out, the success of practical forestry upon these townships chiefly depends. It will be incumbent upon the officials

having this work in charge to see that the rules for governing conservative lumbering are thoroughly enforced in order to bring about the desired results. All the rules suggested for governing the removal of timber should be included in any contract of sale of the timber stumpage, and the penalties advised for a non-observance of the rules should also be fully stated and included in the agreement and signed by the purchasers of stumpage.

MARKING TIMBER.

It is customary in marking trees for removal to blaze the butt of each tree, below the point where the stump will be cut in felling the tree, with a hatchet specially designed for the purpose, and stamp the blaze thus made with the head of the hatchet upon which, in the Forest Service work, the initials "U. S." are raised. These letters may easily be changed for State work to the letters "N. Y." or "S. N. Y." or any other symbol which it is desired to use. The marks stamped on the stump make it possible for the inspector to determine whether any trees which were marked for removal have been left, and also whether any trees have been taken which were not marked for removal.

In marking timber to be removed, it has been demonstrated that the best results can be obtained by using not more than three men in a party. The most satisfactory and cheapest tree marking has been done in close forests by using only two men. Commencing upon some well-defined line, it is the usual custom to take a strip through the forest, which will keep the men continually within sight or speaking range of each other, marking all trees within the boundaries of the strip which are to be removed, and each watching carefully to see that no trees over the advised diameter limit are missed. The man on the side nearest the guide line follows its course, and the other members of the marking crew are guided by him. The man on the outside blazes a hardwood tree occasionally on the side towards the forest which has not been marked when there is not a sufficient number of trees marked for removal to make a plainly defined line for their return. After having marked all trees in the strip taken, or until they come to some division line, the top of a mountain, the shore of some pond or lake, or some trail, road or stream, which will clearly define the outskirts of the territory marked, the markers usually turn and mark a strip back, using the outside line of the strip last marked as a guiding line.

A crew of three men, under advantageous conditions, can mark from forty to sixty acres a day. The cost of marking timber to be removed on all these townships should not exceed fifteen cents an acre, and the work should be well and carefully done for that amount.

METHOD OF CUTTING.

There are but two commonly used methods of cutting timber, viz, chopping or sawing. As sawing the timber does away with a great deal of unnecessary waste caused by chopping, this method is recommended for cutting the timber on these townships. It is readily apparent, even to those who are entirely unacquainted with the different methods of cutting, that a tree felled and cut up with a saw must necessarily yield more lumber than one which is cut with an ax. The kerf, when a log is cut with an ax, causes a large loss at the butt, which is usually the best part of the log. A full illustration of the difference between the two methods of cutting, and approximate loss occasioned by chopping timber rather than by sawing, was fully shown and illustrated in the working plan made for Township 40, and for that reason it is not considered necessary here to go any deeper into this subject. It should always be borne in mind, however, that the larger the tract being lumbered the greater would be the corresponding loss by allowing the timber to be cut by the more wasteful method of chopping.

In cutting spruce and balsam logs on this tract it is advisable that they be cut in even lengths of ten, twelve, fourteen and sixteen feet, as these lengths make even two-foot lengths of pulpwood when cut up before rossing. An additional length of four inches on each log should be allowed to cover the necessary loss in trimming off the battered, discolored and damaged ends of the logs, caused by their being driven over rocky falls and lying in the water. If the logs were to be manufactured at Raquette Lake, or shipped to some point by railroad which would not necessitate long driving, three inches in additional length would probably cover all necessary trimming.

Sixteen-foot lengths should only be allowed when they are cut for the purpose of saving timber or bringing the cutting point in the top of the tree to the desired limit. No butt logs should be allowed to be cut sixteen feet long unless on account of breaks or other visible defects. If longer lengths than sixteen feet were allowed to be scaled at the top end it would cause a loss to the State on account of the taper and decrease of the diameter when compared with timber cut thirteen feet long, this being the length upon which the scale rule advised is based. If the timber were cut into even two-foot lengths from ten to sixteen feet, and the quantities above and below the thirteen-foot standard length were evenly balanced, there would be no appreciable loss. In cutting the pine timber it is advised that logs be cut into lengths of ten, twelve, fourteen and sixteen feet, as may be best in relation to punk knots, breaks, crotches and other defects. All pine timber should be carefully looked over and measured to the

required diameter limit in the top before a log is sawed, and the length of the different logs should be varied on the above-mentioned lengths in order to bring the diameter limit of the top log to the required diameter in the top of the tree. If there are visible defects in the tree, they should be noticed before the cutting up of the tree commences, and the length varied to remove them with the least possible loss. By adopting this method a great deal of valuable timber can be saved and utilized which might otherwise be lost.

CUTTING HEIGHT OF STUMP.

It is always advisable in felling timber to cut the tree at the lowest practical point, because the timber in the body of the tree is usually of the best quality, clear and free from pin knots, and, if sound, the butt log is actually worth more for manufacture than any other portion of the tree.

Another reason is that cutting at the lowest point very often materially increases the amount of scale allowed for the tree, since a slight difference either way in the height of the stump may increase or decrease the diameter an inch in the top of the logs into which it is cut.

It is customary to scale logs in full inches, all fractions of inches being raised or lowered to the nearest full inch. Fractions below one half are dropped to the full inch below, while those above the half inch point are called at the next full inch above. It very often occurs that the diameter of a log is so near the one half inch point between full inches that the increase in diameter which would be gained by cutting a low stump is sufficient to put the first log into a next higher inch class than would be allowed if a high stump were cut. Frequently this increase extends to every log in the tree. This apparently trivial difference in scale may seem to be of very little importance, but in reality it is just such little points as this that serve to make or mar the profits of the average lumber job.

It has been claimed by some that cutting high stumps was an advisable policy on account of the saving in time and labor sometimes necessarily expended in "butting" or cutting off portions of the butt of a tree which is found to be affected by heart rot, frost checks, wind shakes or other defects. This, however, is a very nonsensical claim, as a tree can very seldom be cut high enough to remove such defects when they exist, and another cutting usually has to be made, sometimes several, before the proper point to effectually remove such affected portions is reached. It is impossible to judge with absolute certainty from external appearances what the conditions are in the heart of a tree, and this theory could

only hold good upon trees which were but slightly affected near the roots, while upon all sound trees cut in this manner there would be an entirely unnecessary loss. It will readily be seen that a foot in length of clear timber in the butt of a tree, where the diameter runs from fourteen to thirty inches, is worth several feet of timber in the top of the tree. Moreover, the clearest and best timber is found in the butt, and the smallest, most knotty and least valuable in the top.

An arbitrary height of stump for cutting trees cannot be fixed to suit all conditions. The cutting point must depend upon the locality and the position in which the tree stands with reference to other trees, rocks, fallen timber and other obstacles; but it is recommended that no cutting more than six inches above the top of the root swelling be allowed on these townships, unless it is absolutely necessary on account of some obstruction.

The following figures were taken by experienced men on Townships 40 and 39 during the summer of 1900, and will furnish reliable information of the comparative differences in diameter of spruce at breastheight (four and a half feet from the ground), at the top of the root swelling, and at the lowest practical cutting point, from ten inches in diameter at breastheight up to thirty inches. It is the result of careful measurements of over 2,600 trees, taken with reference to natural obstacles, to determine the lowest practical cutting point. They may be relied upon for spruce on these townships, which adjoin the tracts from which the figures were taken. The table explains itself.

TABLE OF COMPARATIVE AVERAGE DIAMETERS OF SPRUCE.

At breastheight, 4½ feet from the ground.	At lowest practicable cutting point.	At top of root swelling.	At breastheight, 4½ feet from the ground.	At lowest practicable cutting point.	At top of root swelling.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
10	11.9	13.0	21	24.1	25.9
11	13.0	14.1	22	25.3	27.1
12	14.1	15.3	23	26.4	28.2
13	15.2	16.5	24	27.5	29.4
14	16.3	17.7	25	28.6	30.6
15	17.4	18.8	26	29.7	31.7
16	18.5	20.0	27	30.9	32.9
17	19.7	21.2	28	32.0	34.0
18	20.8	22.4	29	33.1	35.2
19	21.9	23.5	30	34.2	36.4
20	23.0	24.7			

DIAMETER LIMIT AT TOP END.

That only a slight difference in scale is gained by cutting the top log of a tree at the top end to a four or five inch diameter limit rather than six inches, is shown by the following table, obtained by very careful measurements on 1,064 spruce, and represented in nineteen-inch standards by Dimick's Rule:

DIFFERENCE IN SCALE BETWEEN CUTTING THE TOP LOG TO FOUR OR FIVE INCHES AND TO SIX INCHES AT THE TOP END.

DIAMETER BREASTHIGH.	Number of trees analyzed.	Total gain by cutting to 5 inches rather than to 6 inches.	Average gain per tree.	Total gain by cutting to 4 inches rather than to 6 inches.	Average gain per tree.
Inches.		Standards.	Standards.	Standards.	Standards.
10 and over	1,064	3.39	0.003	4.06	0.004
12 and over	883	2.16	.002	2.52	.003
14 and over	602	.44	.001	.26	.0004

It is true that were the purchaser of stumpage to manufacture his own timber, the value of the additional timber which the smaller limit would yield would be greater than the table indicates, and, on the other hand, there would be no very appreciable gain in scale to the State. It is also probable that log buyers and dealers in pulpwood will offer some objections to removing the timber to as small a diameter as five inches, since when a tree is cut down to six inches in diameter in the tops there is usually but little timber having any commercial value remaining, even for pulpwood. Pulp logs cut to this diameter, however, are being purchased by dealers throughout the State and there is no difficulty in disposing of timber so cut, if it be sold with the balance of the timber in the tree. Still, in consideration of the fact that the forest would be benefited by the removal of just so much more of the objectionable tops, and the danger of damage by fire proportionately decreased, it is considered advisable in lumbering these townships to require that all merchantable spruce and balsam timber be cut and utilized down to a diameter of five inches in the top of the tree.

Should any merchantable timber over five inches in diameter at the small end, long enough to yield a four-foot stick of pulpwood, be left in the tops, it should be scaled and charged double to the purchaser of the stumpage as a penalty for leaving it, unless there be some visible defect or reason satisfactory to the inspector why it should not be taken. The length of logs can be varied

by cutting them in even two-foot lengths of pulpwood, ten, twelve fourteen and sixteen feet (sixteen-foot lengths should only be allowed in the top logs), to bring the cutting point to the desired limit in the top of the tree. Logs in the tops might be cut to any smaller diameter than five inches by the contractor if he so desired, but when so cut they should be scaled and included at the stated limit. For example, if a spruce log be cut down to four inches in the top, sixteen feet long, it should be scaled and taken as a five-inch log to counteract the effect of the increased taper near the top of the tree.

An eight-inch diameter limit in the top is advised for cutting the pine. Pine logs are not generally considered merchantable when cut shorter than ten feet in length and eight inches in diameter at the top end. No timber which will make a log of these dimensions should be allowed to be left in the woods. The lumberman or contractor should be allowed to cut pine timber in the tops down to a smaller diameter if he desires to do so, and should be charged only what it actually scales, as he will be removing objectionable timber from the tract by so doing. In cutting pine the contractors should cut the logs in ten, twelve, fourteen and sixteen foot lengths, as the particular tree being cut might require. No longer length of timber than sixteen feet should be allowed to be cut and measured at the top end except for the purpose of saving timber. There are slight changes from the diameter limits advised in Bulletin 30, but after a careful study on the subject it is considered to be for the best interest of the forests that these slight changes in the policy formerly advised be made, and they should also apply to Township 40.

FELLING TIMBER AND CUTTING ROADS.

The greatest care should be exercised in felling trees, in order to minimize the damage done to the small growth. A large amount of unnecessary destruction of young and valuable species is caused by carelessness on the part of the men felling the timber. Much of this can be prevented by the exercise of care in selecting an opening where the least possible damage will be caused. This should be done whenever possible.

In locating and cutting out roads no more cutting should be done than is actually necessary to make a sufficient passage for the loaded teams. Many lumbermen make a very serious mistake by cutting too many roads for the area to be lumbered, and cutting them wider than is really necessary. Much damage is also caused by building more skidways than are needed. By cutting more branch roads than are necessary the lumbermen lose not only the cost of cutting out and leveling up, but they are also compelled in the winter to break out and

fit up additional roads for hauling their timber. This is poor business policy for the lumberman and also causes unnecessary damage to the forest. More skidways than are necessary means, in a winter of deep snows, an increased expense to lumbermen for shoveling the snow off from the front and top of the skidways. Much of the unnecessary cutting and clearing out caused by making too many roads and building too many skidways can be avoided by a careful location of the roads and by cutting out no more branch roads than are absolutely necessary to reach the timber without skidding logs too far, and by building larger skidways whenever practicable to do so, rather than many small ones.

There can be no set rules for the distance which logs should be skidded, nor the exact number of roads to be cut on different tracts, since the number must vary according to the topography of a tract and the point to which it is desired to bring the timber. The location of main roads and branches should be under the direct supervision of the inspector in charge of the lumbering operations, and no extensive road work should be entered into which has not first received his sanction.

USE OF TIMBER FOR BUILDING SKIDWAYS, CORDUROYS AND BRIDGES.

In selecting the timber to be used for building skidways, corduroys and bridges, the hardwoods should be used whenever possible. Down timber and some of the "butts" or affected logs which it is clearly evident will not be accepted by the scaler can very often be used for the blockings for the front end of skidways. This use of such timber is often cheaper for the lumberman and much more satisfactory to the forester than if the men were allowed to cut down valuable young trees for the purpose. Furthermore, it is at times practicable and economical to build skidways with portions of the trees intended for logs, cutting the skids in lengths of two or three logs, as the holding capacity of the skidway may require, using them for skids until the logs are hauled off from them in the winter, and finally cutting them in proper lengths for logs and hauling them to the landing.

One advantage which the lumberman gains by using this large, heavy timber for skids is that, although it takes a little more time to get the logs into position, they do not require as much blocking up to raise them to the proper height. Another is that the danger of large skidways breaking down after the logs are rolled upon them is removed. Timber cut from small spruce trees should not be used for building skidways, corduroys or bridges, unless it is impossible to find other timber of less value within reasonable distance. As a rule in the Adirondacks, it is seldom impossible, and the question of what constitutes a reasonable

distance should be left to the judgment of the inspector. The necessary timber for leveling up inequalities in logging roads, for stringers, and for covers for side hill and corduroy roads, etc., can often be gathered from the dead and down timber at the least expense, obviating the necessity of cutting young and valuable growth which it is desired to preserve.

When young spruce is used without the inspector's approval, it should be scaled and charged to the purchaser of the stumpage or contractor at double scale. For example, if a stick fourteen feet long and five inches in diameter at the top end should be unnecessarily cut from a small spruce tree, and used for building corduroys or bridges, such stick should be scaled and charged as an amount equal to the scale of two such sticks. There should be a distinct understanding with the contractor that no smaller diameter limit than five inches should be figured, even on smaller sticks, if cut from small trees without the consent of the inspector. This may appear at first glance to be a very hard and arbitrary rule to impose upon the lumbermen, but a careful study of the conditions existing on other lumbering operations in the Adirondacks where there is no such rule, and a knowledge of the subject gained by experience convinced the author of the necessity of having some such clearly understood penalty, in order to fully protect the State from suffering from repeated small violations. These transgressions are hardly of enough consequence, considered singly, to warrant an open rupture or a rescinding of contract, but, if allowed to go unchecked, will materially interfere with the proper lumbering of these townships. The application of this penalty will preserve for the State in many localities much of the young and valuable growth which would otherwise be unnecessarily destroyed. The incorporation of this rule in a contract would give the inspector in charge of the lumbering the right to use his own judgment to decide whether or not it were necessary to use the young growth. There are certain localities on these townships where it might be advisable to use some small spruce, on account of the benefit which the remaining trees would receive by being carefully thinned, but the decision cannot be safely left to the discretion of the men removing the timber.

LOPPING TOPS.

It is advised that the tops of all trees cut for logs or timber upon these townships be thoroughly lopped, as there can be no question that the proper lopping of tops is of the greatest importance in preventing serious damage to the remaining species by fire. Strong objection is often made to lumbering a forest on the ground that lumbering makes it more susceptible to the ravages

of fire. A careful and thorough lopping of the tops reduces this danger to the minimum. When the tops are not lopped, they are held up from the ground by the limbs underneath, and usually at some time during the early spring or summer the small branches become exceedingly dry and an easy prey to fire. When the forest is in this dangerous condition, fires are often started by the careless dropping of a match, or the throwing away of the stump of a lighted cigar. Once such a fire gets started it is almost impossible to combat it successfully. The flames run swiftly from one top to another. Sheets of flame leap up through the branches of the young trees, which usually catch fire and are killed. Often, when the ground cover of a forest is very dry, it is almost impossible to check a forest fire entirely until it has run out of the territory of old cuttings and slashes.

For these reasons it is strongly advised that the tops of all trees cut in lumbering on these townships, not wholly broken by the fall, be sufficiently lopped to bring them to the ground, or so that the first winter's snow will crush them to the earth. They will then absorb the moisture and become so wet and soggy that decay sets in much more quickly, and they soon get in such condition that they will not burn in an ordinary summer. The danger from fire is thus materially decreased.

The cost of thoroughly lopping tops varies with the conditions on different tracts. Usually it is from two to three cents per standard log, varying according to stand of timber, the diameter limit to which cutting is made and the degree of thoroughness with which it is done. Lopping tops is a useless expense unless it is thorough.

The smaller the diameter limit to which timber is cut in the top of a tree the less the cost of lopping tops. For example, it is plain that if the tops are cut off at a diameter of eight inches, more branches remain to be lopped than if they had been cut at a five-inch diameter. On the same general principles, the larger the stump diameter limit the less will be the cost of lopping tops per standard, since the lopping costs no more for a tree containing two to three standards than it does for a tree containing only one standard, cutting to the five-inch diameter limit in both cases. Therefore the cost of lopping tops on these tracts, if cut to a twelve-inch diameter limit, breasthigh (which is practically fourteen inches on the stump at the cutting point), would be considerably less per standard than if the trees were cut to a ten-inch diameter limit, as there would be a smaller number of tops from which to cut the limbs, as well as less lopping in proportion to the yield.

A little care exercised in the felling of timber makes a decided difference in the work of lopping the tops. If several tops are felled together, thereby forming a slash, the cost of lopping will be materially increased. Even when lopped, such tops, if not scattered about on the ground, will remain held up from the earth by the limbs under them, and will thus be prevented from receiving the earth's moisture and becoming dampened.

It is not advisable to include the lopping of tops in the contract for the sale of the timber stumpage. In order to secure satisfactory results, the lopping of tops should be made a separate and distinct piece of work, and its execution should be placed entirely in the hands of the inspector. The cost of lopping the tops upon these tracts should not be more than two cents per standard (or ten cents per thousand feet board measure), including the lopping of the tops of all trees cut in building log roads, clearing out for skidways, and erecting camps, dams, etc. The work of lopping should be very thoroughly done for that amount.

OUTLETTING ROADS TO LAKES.

In locating roads for hauling logs to lakes or across them, care should be exercised to bring them to the lakes in points as near as possible to the back ends of the bays and the inlets of the small streams. No more roads should be cut through the reserved strip along the lake front than are absolutely necessary for the purpose of removing the timber, nor should the roads be cut any wider than necessary for the passage of one loaded team at a time. No clearing out for the purpose of skidding logs should be allowed upon the shores of the lakes, since the clearing out of spaces large enough for the skidways, and the consequent cutting of skidding roads and trails leading thereto, gives to the lakeshore a very unsightly appearance, which can as well be avoided.

Whenever the topography of the locality makes it necessary to bring out roads on the shore at points where there are no streams coming into the lake, such roads should be so located as to reach the lake on an abrupt curve, in order to cut off the view from the lake. They should not be brought to the lake in a long, straight line.

Reasonable care in locating roads, keeping skidways from the lakeshores, and allowing no unnecessary roads to be cut through the lake-front reserve will prevent the lumbering operations from being too apparent. A wise management of the shore end of the log roads is fully as necessary to preserve the natural beauty of the forests as is the leaving of reserve strips along the lakeshore or of summit reserves on the tops of mountains.

SCALE RULE ADVISED.

The nineteen-inch Standard Rule has been used as the basis for calculating the stand of timber on these three townships. The unit of calculation in this rule is a log thirteen feet long and nineteen inches in diameter at the small end. Logs of a larger diameter than nineteen inches are figured as one standard and a fraction, and logs of a smaller diameter than nineteen inches are figured as a proportionate fraction of the standard.

The use of this rule for determining the amount of timber stumpage sold from these townships is advised for the following reasons: The nineteen-inch Standard Rule is the best known and understood throughout the Adirondack region, and will commend itself to the purchaser of stumpage from the State, and to the manufacturers, for this reason. It is, moreover, in the opinion of the majority of the lumbermen, mill men, manufacturers, jobbers and contractors throughout the Adirondacks, the fairest rule for both buyer and seller. It is preferable to a board-foot rule for the reason that most board-foot rules do not allow a sufficient amount for the small logs. Upon these townships there will be a large number of small logs in the tops of the trees, and as such timber when sold collectively with the larger logs brings the same price per standard, it is advisable to use a rule which will give as nearly as possible the actual contents of small as well as of large logs. It is believed that these requirements will best be served by the adoption of the nineteen-inch Standard Rule.

In calculating the volume of the hardwood timber the old Scribner Rule has been used for the reason that it is considered more advisable to use a board-foot rule for this kind of timber. This rule is more nearly accurate for small logs than is any other of the board-foot rules. It has repeatedly been proved by manufacturers and mill men that neither the Standard Rule nor the old Scribner Rule allows more merchantable material for the smaller logs than they actually contain.

METHOD OF SCALING.

The method of scaling advised for this tract is the one in common use under the Standard Rule, viz, measuring the diameter at the top end of each log. Its use is recommended with the following provisions:

The maximum length for measurement of all spruce logs should be fourteen feet, and of all pine logs sixteen feet, except where extra length is allowed to avoid defects. Otherwise, longer logs should be scaled as two or more logs.

All timber cut for dimension stuff, booms, piling or building material should be scaled at each thirteen-foot length when practicable. Scaling long timber at

the top diameter is not just, and would cause a serious loss to the State on account of the large amount of taper from the butt diameter to the top diameter.

When timber is in such a position that the thirteen-foot points are not accessible, as when rolled in skidways, every log should be measured at each end and the average of the two measurements taken as the diameter.

The customary rule of accepting the diameter of logs at the nearest full inch above or below the actual diameter may be followed on these tracts.

No pine logs should be allowed to be culled or left in the woods that will yield twenty-five per cent or over of sound, merchantable timber. Such logs should be scaled and taken at their actual merchantable value, both the end area and the length of the log being taken into consideration in calculating the contents.

Merchantable timber in pine should be construed to be timber that will yield sound lumber of the minimum length of ten feet.

Spruce and balsam timber should be scaled and taken at its actual merchantable value whenever twenty-five per cent of its total scale is timber fit for merchantable pulpwood.

These rules are essential in order that the State may not be the loser by careless or inefficient cutting, since much valuable timber is often wasted by slovenly work, more especially in cutting pine. The incorporation of these rules in a contract will do away with much of the careless and wasteful methods of cutting timber.

The scalers should be in the employ of the State, and the number employed should be determined by the amount of lumbering going on. The scalers can be of great assistance to the inspector by acting as assistant inspectors, and aiding him in seeing that the rules prescribed for lumbering are properly carried out. They should be selected wholly with reference to their impartiality, capability, and reliability, and should be directly responsible to the inspector in charge of the lumbering operations.

RULES TO BE EMBODIED IN A LUMBERING CONTRACT.

The following rules should be incorporated in any contract made for the removal of timber from Townships 5, 6 and 41. A thorough supervision by trained and experienced men is absolutely essential to good results in the application of these rules.

1. All timber shall be cut with a saw whenever practicable.
2. No timber shall be cut in the reserve strips except with the approval of an inspector.

3. All roads laid out through the reserved strips shall be approved by the inspector before any cutting is commenced.

4. No trees shall be cut for timber which are not marked.

5. All trees marked shall be cut unless a satisfactory reason is given for leaving them.

6. No trees containing merchantable timber shall be left lodged in the woods.

7. No trees shall be cut more than six inches above the swelling of the roots unless a satisfactory reason is given.

8. All merchantable timber in a tree, above the established diameter at the small end, shall be utilized. Any such timber left purposely or through carelessness shall be scaled double and charged at the stumpage rate paid for the timber.

9. No small spruce or pine shall be used for bridges, corduroys, skids, or for building camps or dams, unless the scarcity of less valuable timber makes it absolutely necessary. Any timber so used, unnecessarily, shall be scaled double and charged at the stumpage rate paid for the timber.

10. All merchantable timber necessarily used in building camps, bridges, dams or booms, or for other purposes, shall be scaled and charged to the purchaser at the same stumpage price as if it were cut into logs. Hemlock timber, used for building or for other purposes, shall be charged at the same price as spruce.

11. Unnecessary slashes, caused by felling several trees on top of each other, shall be avoided.

12. All merchantable timber used for building skidways shall be cut into logs, an opportunity for scaling the logs shall be given, and they shall be hauled out, before abandoning the log roads, or closing up the winter's jobs in the spring.

13. Contractors and lumbermen shall be careful not to do any unnecessary damage to young growth in lumbering.

14. The violation of any of these rules, if persisted in, shall be *deemed a sufficient cause of annulling the contract.*

INSPECTION.

The selection of the inspector for overseeing the lumbering operations is of the greatest importance. Upon his capability and judgment depends the successful carrying out of the recommendations made for properly lumbering this or any other tract. He should combine all the qualities of a first-class lumberman and a competent and impartial log scaler. He should also have a thorough knowledge of practical forestry, together with the necessary energy to insure a careful and

thorough inspection of every portion of the tract, at short intervals, while lumbering is going on, enforcing the rules thoroughly in all places.

He should have entire control of the log scalers and tree markers. Any division of authority in enforcing the carrying out of the rules should be carefully avoided. The decision of the inspector should be final on all questions connected with the lumbering. He should decide the particular localities where dams should be erected for the purpose of driving logs, the height to which they should be built, etc., the height to which water should be raised for the purpose of flooding the streams and at what time in the spring they should be left open for the purpose of protecting standing timber from being flooded and killed. He should locate the places where timber should be cut for the purpose of constructing such dams, oversee the marking, selection and scaling of timber for such purposes, etc.

The location of branch railroad tracks, all cutting of roads, the location of camps, and the selection of material which should be used in their construction should all be placed entirely in his charge, as it is only by so doing that the lumbermen can be held in proper control. He should have full control of the lopping of tops, in order to have it done in a thorough and satisfactory manner.

The inspector should be upheld by the officials over him in seeing that the work is properly done. In order that the work may be of a satisfactory character to the people of the State, it is absolutely necessary that the man in charge of guarding their interests in the forest should have the authority to stop lumbering operations at *once* on any portion of the tract or tracts under his supervision, when, in his judgment, it has become necessary to do so. The very fact that the purchasers of the stumpage know that the inspector has this power, which can immediately be put into operation when necessary, will cause them to be more careful to observe the rules, and to perform their work in such a manner that they will not be compelled to stop their lumbering operations.

If the inspector is incapable of filling the position to which he is appointed, he should be removed and a more capable man appointed in his place, but it should always be borne in mind that the interests of the people of the State and the interests of the lumbermen are diametrically opposite, and that there will be unavoidable friction between the inspector and the contractor and lumbermen, and undoubtedly complaints from the lumbermen against the rulings of the inspector will be made. Therefore, if he does his duty, no political influence should be allowed to counteract his judgment as to what would be best for the forest.

The inspector should make detailed reports at the end of each month to the proper State official of the number of logs and the number of standards which they contained, scaled on each separate job, and of the general progress of the work. He should also at the end of each month, while scaling is in progress, furnish the lumbermen removing the timber with a statement of the scale of the timber measured, giving the number of pieces and the scale of each species.

NAMES OF TREES MENTIONED IN WORKING PLAN.

CONIFEROUS SPECIES.

COMMON NAME.	BOTANICAL NAME.
White pine	<i>Pinus strobus</i> Linn.
Red (Norway) pine	<i>Pinus resinosa</i> Ait.
Tamarack	<i>Larix laricina</i> (Du Roi) Koch.
Black spruce	<i>Picea mariana</i> (Mill.) B. S. P.
Red spruce	<i>Picea rubens</i> Sargent.
Hemlock	<i>Tsuga canadensis</i> (Linn.) Carr.
Balsam (balsam fir)	<i>Abies balsamea</i> (Linn.) Mill.
Arbor-vitae (white cedar)	<i>Thuja occidentalis</i> Linn.

BROADLEAF SPECIES.

Aspen (poplar)	<i>Populus tremuloides</i> Michx.
Large Tooth aspen (poplar)	<i>Populus grandidentata</i> Michx.
Paper (white) birch	<i>Betula papyrifera</i> Marsh.
Yellow birch	<i>Betula lutea</i> Michx. f.
Hornbeam	<i>Ostrya virginiana</i> (Mill.) Koch.
Beech	<i>Fagus atropunicea</i> (Marsh.) Sudw.
White elm	<i>Ulmus americana</i> Linn.
Wild red (bird) cherry	<i>Prunus pennsylvanica</i> Linn. f.
Black cherry	<i>Prunus serotina</i> Ehrh.
Sugar (hard) maple	<i>Acer saccharum</i> Marsh.
Silver (soft) maple	<i>Acer saccharinum</i> Linn.
Red (soft) maple	<i>Acer rubrum</i> Linn.
Basswood	<i>Tilia americana</i> Linn.
White ash	<i>Fraxinus americana</i> Linn.
Black ash	<i>Fraxinus nigra</i> Marsh.

UNDERGROWTH.

Mountain (spotted) maple	<i>Acer spicatum</i> Lam.
Striped maple (moosewood)	<i>Acer pennsylvanicum</i> Linn.
Witchhopple	<i>Viburnum lantanoides</i> Michx.

